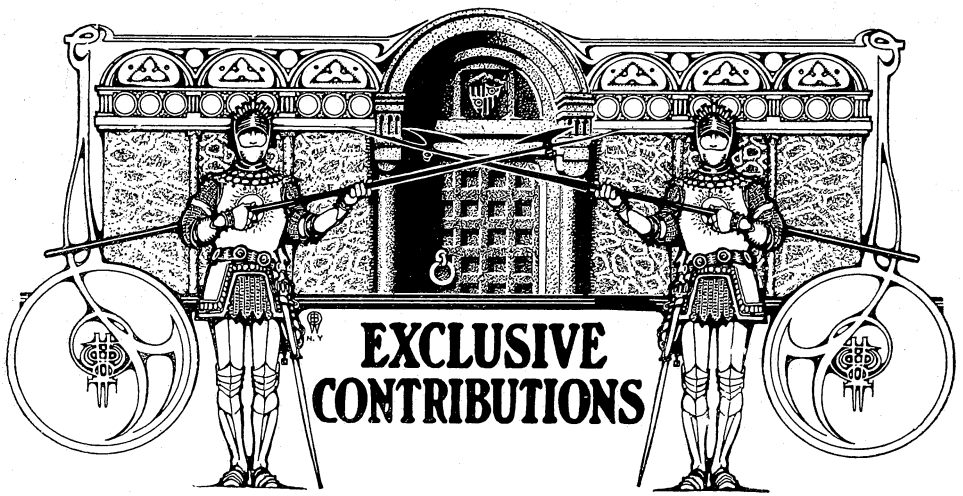


Dental Radiography.*

By Howard R. Raper, D.D.S.,
Professor of Operative Technic and Roentgenology at Indiana Dental College, Indianapolis.

X-Ray Tubes.

Thus far we have considered only the electric phase of the subject. We shall now describe the apparatus through which the electricity is passed, and which generates the X-rays, namely the X-ray tube.

An X-ray tube is a bulbular glass tube, from which the atmosphere has been exhausted to quite a high degree of vacuum—about 1/1,000,000 part of an atmosphere. It should be remembered that there is a something which occupies all space, even vacuua, and that something is known as ether. There is, of course, ether in the X-ray tube. X-ray tubes are often called Crooke's tubes, but they resemble the tube made by Professor Crooke only in having a high degree of vacuum. In mechanical construction they are quite different.

Tubes may be divided into two classes: those designed to be used on an induction coil or interrupterless coil, and those made to be used on a high frequency coil. We shall describe the former first.

Simple Tubes.

Sealed in the X-ray tube are the anode Fig. 39-A (also called anti-cathode and target), and the cathode, B. The anode is usually flat, placed at an angle of 45 degrees to the long axis of the tube, and made of some high-fusing metal, such as platinum, iridio-platinum or tantalum. The cathode is concave, saucer shape, and usually made of aluminum.

Since, in connecting the tube to the coil, it is necessary to attach the connecting terminal tape or wire from the positive side of the coil to the target end of the tube, we must be able to determine which is the positive terminal of the coil. This may be done on an induction coil, as follows: Cut out the resistance of the rheostat, adjust the sliding rods to about one-half the distance of the maximum spark gap, and throw on the switch. The spark will jump the gap so quickly that it is impossible to learn by simple observation in which direction it is traveling. By watch-

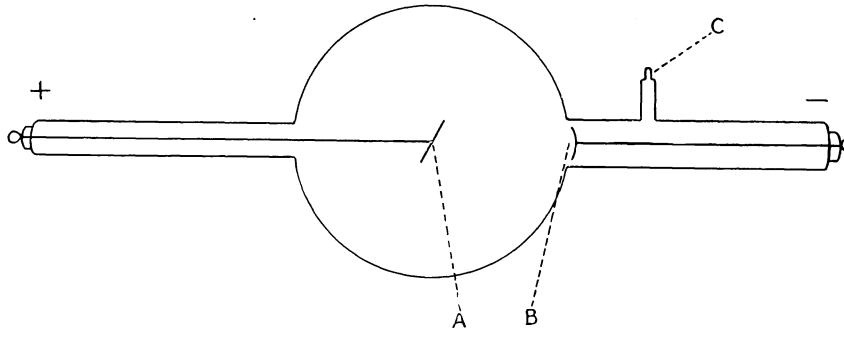


Fig. 39. A, anode. B, cathode. C, point at which the atmosphere was pumped from the tube.

ing the large disc terminal, however, this can be determined. If on throwing the switch on and off the spark is noticed to cling to the edge of the disc *always,* then the current is passing from the disc. If, however, the spark occurs from the surface of the disc just as the current is turned on (it may then seek the edges), the current is traveling from the small bulb to the disc. (Fig. 40.)

With the tube properly connected to the coil as per Fig. 41, the current is shunted (Fig. 42) through the tube, instead of jumping the spark gap, passing from anode to cathode. Whether the current will choose the path through the tube or jump the spark gap depends on which offers the less resistance. A current of electricity always travels the path of least resistance.

Tubes are designated according to the degree of their vacuum. Thus we have the high or hard tube, in which the vacuum is well nigh complete; the medium tube, in which the vacuum is less complete, and the soft or low tube, in which the vacuum is least complete. High tubes offer the greatest resistance to the passage of the electric current through

them, then comes the medium, while the low vacuum tube offers the least resistance. For dental picture work a tube should be high or medium, preferably high.

The operator may determine whether a tube is hard, medium or soft, as follows: Connect the tube to the coil. (Fig. 41.) Separate the sliding rods to give a spark gap of two or three inches and turn on the current. Unless the tube is very low indeed, the current will jump the spark gap instead of passing through the tube. Let us suppose the cur-

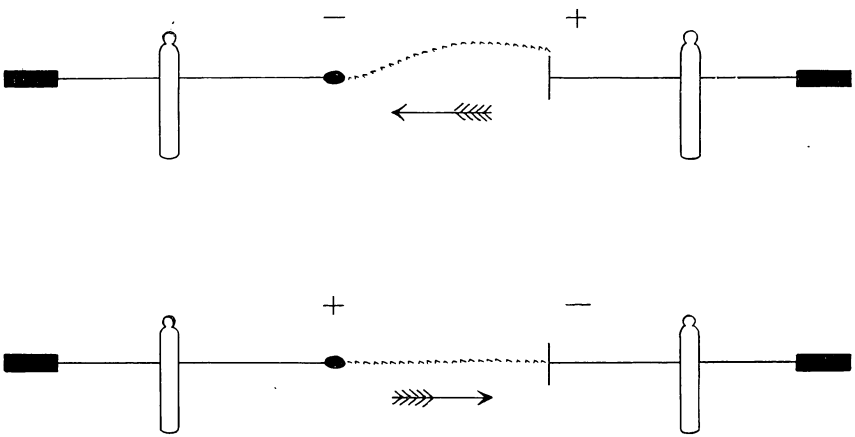


Fig. 40.

rent does jump the spark gap. Now widen the gap a little; turn on the current, and it passes through the tube. The tube will, therefore, be rated as one of low vacuum, offering a resistance slightly greater than two or three inches of atmosphere. When the current jumps the spark gap instead of passing through the tube, the tube is said to have "backed up" so many inches — the number of inches of the gap — of "parallel spark." Thus a low tube will back up two or three inches of parallel spark; a medium tube will back up four or five inches of spark; a high tube will back up six or seven inches of spark, and a very high tube will back up eight or nine inches of spark. Very high tubes offer so much resistance that only the largest coils are able to force sufficient milliamperage through them to make good X-rays. A tube that will back up more than nine inches of spark is too high to be useful; it is impossible to force enough milliamperage through it.

From the foregoing it will be seen that any coil smaller than one with an eight-inch spark gap could not well excite a high tube, and that at least a ten-inch coil is necessary to light a very high tube. It seems, too, that any coil with a spark gap wider than eight or ten inches is needlessly large. The coils with the long spark gaps are, however, seldom able to throw a fat, fuzzy spark farther than eight or ten inches. The throwing of a thin, blue spark a greater distance is simply incidental and

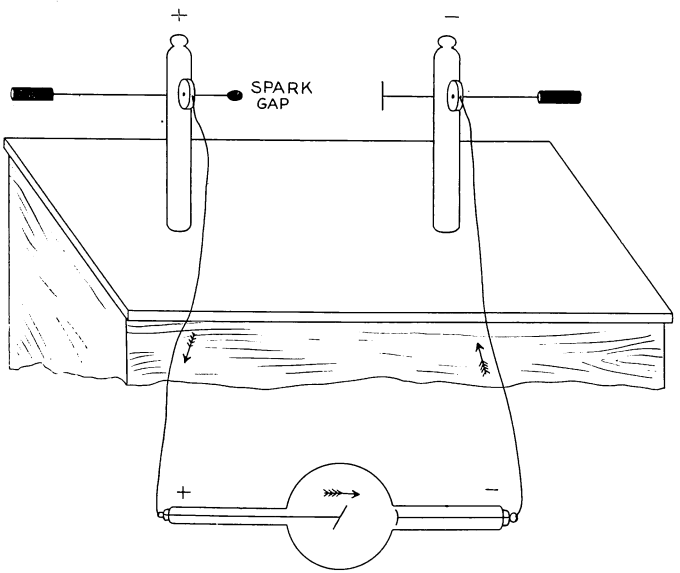


Fig. 41. The X-ray tube connected with the induction coil.

without practical usefulness. Thus an eight or ten-inch coil may be as powerful as one with an eighteen or thirty-inch spark gap; that is, capable of forcing as high a milliamperage through a high tube. If, however, a coil can force any kind of a spark at all through from eighteen to thirty inches of atmosphere, we may be sure it will send a high milliamperage through a good radiographic tube, or, what is the tube's equivalent in resistance, six or eight inches of atmosphere. It is so well understood to-day that the coil with the very wide spark gap is not necessarily more powerful, that manufacturers are making practically all of their coils with from an eight to a twelve-inch spark gap, then rating them according to the milliamperage they can force through this resistance.

To light a tube well a coil should be capable of giving a fat, fuzzy spark, the distance of the parallel spark which the tube backs up.

The tube thus far described is the simplest form of X-ray tube. Next in simplicity is the bi-anodal tube. (Fig. 43.)

Bi-anodal Tubes.

When the two anodes are connected, as in Fig. 43, the positive terminal may be attached to either anode or assistant anode, preferably the anode. The advantage of the assistant anode is a matter on which authorities have widely different opinions. One manufacturer, a man who is making one of the very best tubes on the market, tells me that he

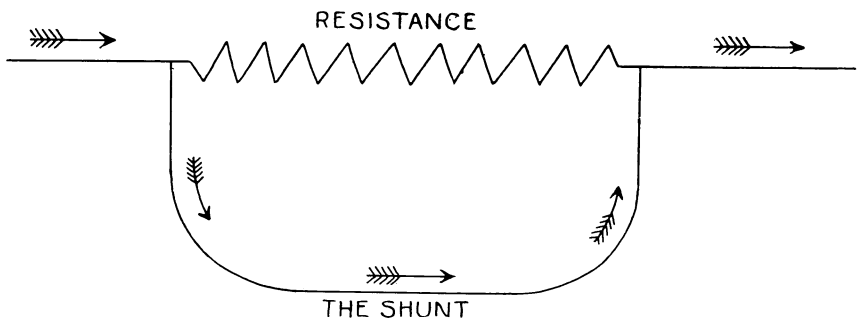


Fig. 42. The arrows show the current flowing through the shunt.

puts the assistant anode in his tubes because some of his customers demand it, and he is able to do so without impairing their efficiency; that his tubes would be just as good with but one anode. Remember the vacuum of an X-ray tube is not perfect; there are some gases in the tube. The function of the assistant anode is to draw these gases back of it away from between anode and cathode. Thus, if the removable wire connecting the anode and assistant anode (Fig. 43) be removed and the tube hitched to the coil, the positive terminal being attached to the anode, the tube will work with a slightly lower vacuum, because the assistant anode does not draw gases back of it. Tubes with assistant anodes are supposed to be capable of transmitting a greater milliamperage.

We have divided X-ray tubes into two grand classes: those designed to operate on an induction coil or interrupterless coil, and those designed to operate on a high frequency coil. Each of these classes may be subdivided into tubes with a means for regulating their vacuum (Fig. 44), and tubes without a means for regulating their vacuum (Figs. 39 and 43).

Tubes without regulators are no longer in general use, because, with use, they soon become too hard, and must be sent back to the manufacturers to be opened and re-pumped. This is expensive and annoying. A tube too high for use will sometimes drop in vacuum and regain its former usefulness if allowed to rest—remain unused—for a month or so.

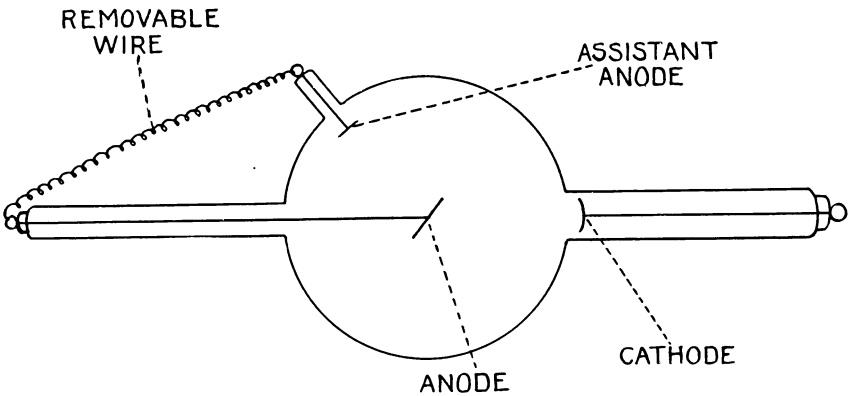


Fig. 43. A Bi-Anodal X-ray Tube.

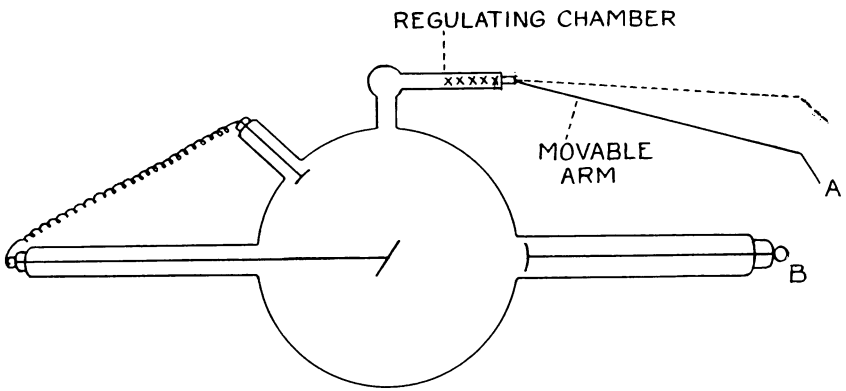


Fig. 44. X-ray tube with vacuum regulator.

Methods of Regulating Vacuum.

There are different methods of regulating the vacuum of X-ray tubes. The most popular and efficient is the one we shall now consider.

The vacuum is governed by means of a movable arm, which increases or decreases the distance be-

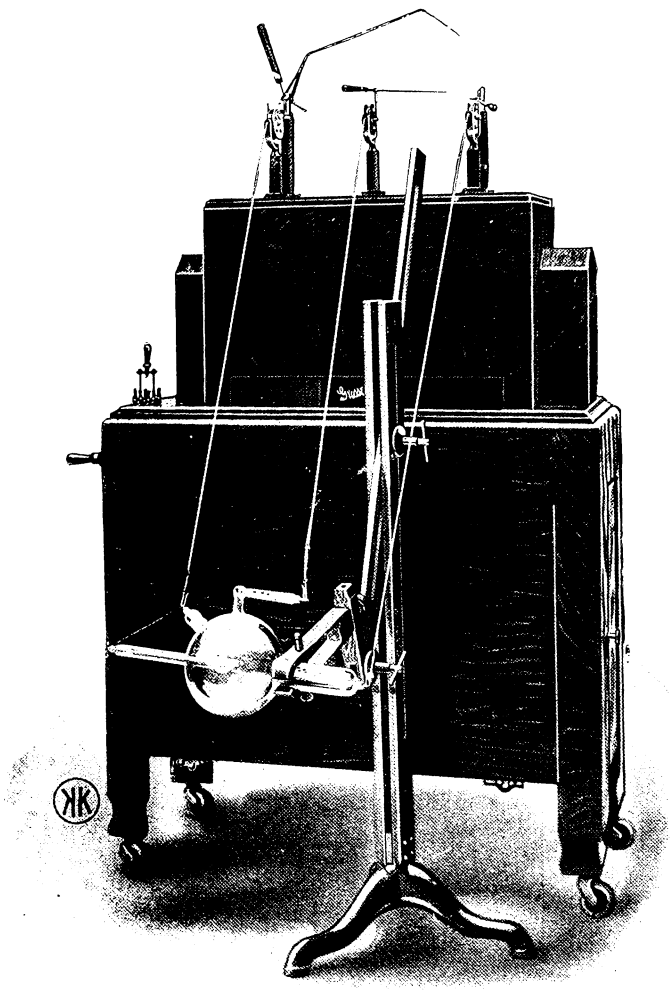


Fig. 45. Showing the manner of connecting the third terminal on the coil with the regulating chamber.

tween A and B, Fig. 44. This distance we shall call the tube-regulating spark gap. The shorter the gap the lower the vacuum can be made; that is, the shorter the gap the less perfect the vacuum can be made.

The current enters the tube and, let us imagine, tries to pass from anode to cathode. The vacuum in the center of the tube is more perfect than around the walls. Hence the path of least resistance is through the

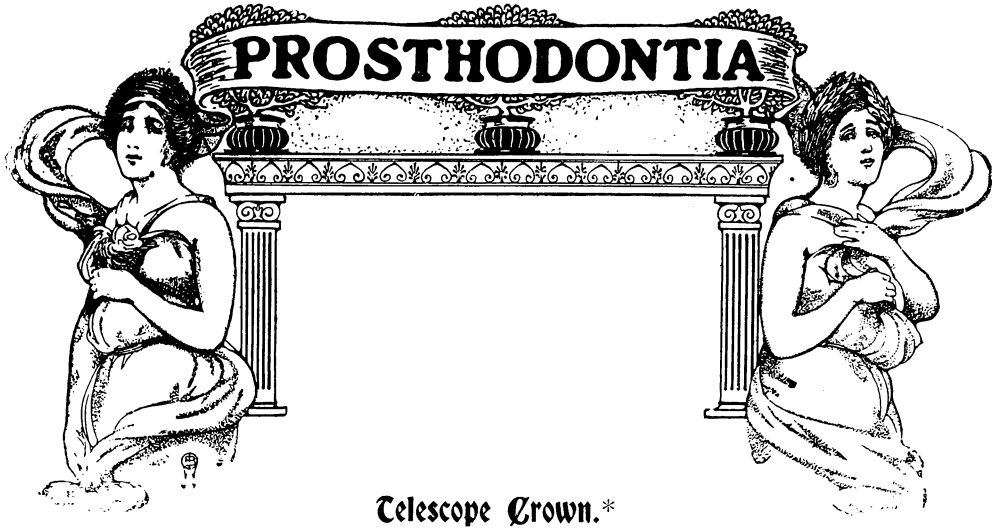
regulating chamber, through the movable arm, through the tube-regulating spark gap, into the negative terminal tape; unless, of course, the tube-regulating spark gap is very wide.

The regulating chamber contains asbestos impregnated with some chemical, sodium or potassium hydrate, for examples. When the current passes through the regulating chamber, heat is created, which causes the chemical to give off gases. These gases lower the vacuum of the tube, so that the current may pass directly from anode to cathode. When the tube cools thoroughly—in the course of fifteen to thirty minutes—these gases are taken up again by the chemicals in the regulating chamber, and the vacuum rises again. Thus the vacuum of the tube is always too high when the tube is not in use, but can be lowered to the desired degree. For rapid picture work, the tube-regulating spark gap should be three to five inches. As the tube gets old the tube-regulating spark gap must be made shorter to obtain the same condition of tube.

When the tube is properly hitched to the coil, and the movable arm set for a high vacuum—to give a regulating spark gap of about four inches—and the current turned on, practically all the current will at first pass through the regulating chamber and jump the tube-regulating spark gap. As explained, this lowers the vacuum, and in a few seconds the current is passing from anode to cathode. All of the current may pass directly through the tube now for a few seconds, but the passage of the current from anode to cathode raises the vacuum and presently some current will be seen to jump the gap for a while. And so on, just as the vacuum raises a little, it is immediately lowered by some of the current passing through the regulating chamber.

Instead of the movable arm, a terminal tape and a third terminal on the coil may be used. (Fig. 45.) Thus the tube-regulating spark is transferred from the tube to the coil. The hitching of a tube to a coil with a third terminal is very simple. Hitch the positive terminal to the anode, or assistant anode if desired, and the negative terminal to the cathode, as usual; and the third terminal to the regulating chamber. The advantages of the third terminal over the movable arm are that the sparking is taken away from the tube and so away from the patient (in radiographic work the tube is always near the patient), and, on some coils, figure 13 for example, the gap may be regulated from the end of the coil where the rheostat and switches are located, so making it unnecessary for the operator to move from his position to change the tube-regulating spark gap.

(To be continued)



Telescope Crown.*

All Metal Bicuspid Crown. Construction Crown.

By Herman E. S. Chayes, D.D.S., New York

The technique for constructing a cast shell crown over a platinum hood for the second bicuspid upper or lower is the same as that for constructing a molar, with the exception that the measurement for the restoration of the tooth in wax is different.

Taking up the upper second bicuspid, we find that the root is somewhat flattened mesio-distally and wider mesio-distally upon its lingual surface than upon the buccal; we find that the contour required is greater at the buccal surface mesio-distally than at the lingual, and let us now assume that the preparation of the tooth has been completed; that is, that the pulp has been extirpated, the walls dressed down according to previously prescribed form (Fig. 1 and Fig. 2), so that every line in the walls of the prepared tooth is at right angles to the plane of the gingival third. We have constructed our hood out of 38-gauge platinum, and we have allowed this hood to sink into a button of inlay wax. We have obtained the high points upon the occlusal surface of the wax crown, and now we study the following geometric figure.

First: In the case of the second upper bicuspid (Chart C, Fig. 1), if we look upon the occlusal surface we find there is described upon it an isosceles triangle, the base of which is a line drawn from the mesio-buccal point of its extreme contour to the disto-buccal one, while the sides are formed by two lines meeting at the center of the morsal plane of the middle third of the tooth, which point forms the apex, harboring or en-

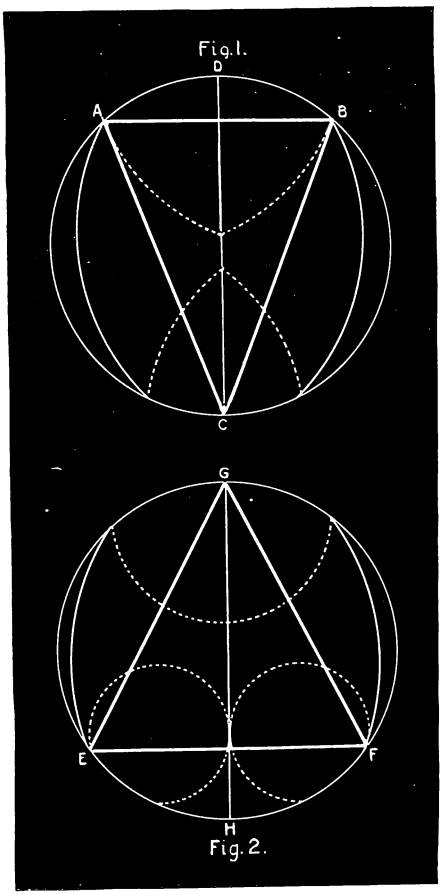


Chart C

EXPLANATION OF CHART C.

Figure 1 is a horizontal section representing the morsal plane of the middle third of an upper second bicuspid. The heavy curved lines within the circle represent the mesial and distal surfaces, while the dotted curved lines indicate the form and proportionate height of the buccal and lingual cusps. A, B and C is an isosceles triangle which has the line A B as the base, and the lines A C and C B the respective sides. The angle A C B is the apical angle, and being bisected by the line C D, this same line will also bisect the lingual cusp of the upper second bicuspid.

Figure 2 is a horizontal section representing the morsal plane of the middle third of a lower second bicuspid. The heavy curved lines within the circle represent the mesial and distal surfaces, while the dotted curved lines represent approximately the buccal and two lingual cusps. E G F is an isosceles triangle, with the line E F as the base, and the lines E G and F G as the respective sides. The angle E G F is the apical angle, and being bisected by the lines G H, the same line will also bisect the buccal cusp of the lower second bicuspid.

closing the apical angle, which, if bisected, the same line would also bisect the lingual cusp of the tooth. It can be proven that upon the arcs remaining after outlining the isosceles triangle there can be placed all the pyramidal forms illustrated and spoken of in the previous section of this series.

In the case of the second lower bicuspid (Figs. 3 and 4; Chart C, Fig. 2), the arrangement of the isosceles triangle is precisely the reverse of the upper one, the base being formed by a line drawn upon the morsal plane of the middle third of the tooth from its mesio-lingual extremity to its disto-lingual one, while the two sides are formed by two lines drawn from these respective points to a point upon the buckle cir-

cumference of the morsal plane of the middle third, which forms the apex of the isosceles triangle and encloses an apical angle which, if bisected, the same line would bisect also the buccal cusp of the tooth. These two *occlusive* triangles are in no way an indication of the central cube or form of the tooth which remains standing after the removal of all the enamel walls, which must be disposed of in the preparation of these teeth for the reception of shell crowns. They are merely an indication of the peculiar natural formation of the cusps, and tend to show that throughout the development of these teeth used in trituration Nature attempts to produce a form which, by virtue of its very construction, would

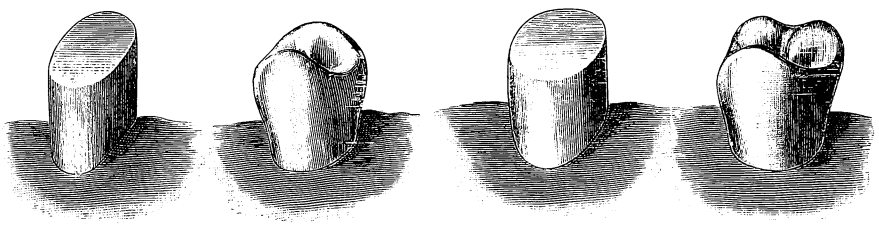


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

be best fitted to resist the greatest amount of stress. The proper contour of both the upper and lower second bicuspids is of vast importance to the patient; more so because of the fact that it is at that point that the dip of the mandible begins, and it belongs to an area which, beginning with the mesial angle of the second bicuspid and terminating with the mesial line of the disto-buccal cusp of the second permanent molar, contributes to the construction of the most efficient masticating area in the mouth.

It is also a point, as we shall see in a subsequent article of the series, where it is particularly essential to procure great strength and rigidity in the construction of bridge work.

In the first article of this series on "Crown Work" it was stated that crowns may be divided into three distinct classes: metallic, non-metallic and combination crowns.

Combination Crown.

For the purpose of proper and more convenient sequence it proves advisable to take up the combination crown before touching upon the non-metallic ones.

A combination crown is usually understood to be one consisting of a porcelain body and a base of a metal such as gold or platinum, or iridio-platinum, or porcelain and gold in combination with iridio-platinum.

It is applicable to any tooth in the oral cavity, provided the root used be serviceable and proper anchorage be possible.

As a law in the construction of these crowns, we must always remember that with the increase of contact surface between artificial appliances always comes increase of resistance to stress, provided, of course, that such contact surface be obtained along the proper mechanical lines.

There are five factors to be considered in combination crowns in their relation to each other and in their relation *en masse* to the surrounding tissues:

First: The condition and position of the root.

Second: The post; its size and direction.

Third: The artificial crown to be used.

Fourth: The inlay base which is to unite the root and crown; that is, the gasket which is to be so constructed that it will at the root end so engage the root as to make splitting of the latter an impossible occurrence, and which will be so constructed at the crown end as to similarly engage the porcelain; and

Fifth: *En masse* the four factors mentioned above must combine to produce a result which shall in every way, color, size, occlusion and articulation be in absolute harmony with the surrounding dental members.

Posts in Crown Work.

Iridio-platinum posts are used in the construction of detachable post crowns, as they are called. The post for the respective teeth are of the following sizes—and in order to avoid repetition it is well to remember that whenever the word gauge is mentioned it is the Brown and Sharp gauge which is meant:

TEETH	SIZE OF POST IRIDIO PLATINUM
Upper central incisor and cuspids	12-gauge post
" lateral incisor	14 " "
" bicuspid, single root	14 " "
" " bifurcated root	16 " "
" molar, palatal root	16 " "
" " buccal roots	18 " "
Lower central and lateral incisor	16 " "
" cuspid	13 " "
" first and second bicuspid	14 " "
" molar, distal root	16 " "
" " mesial canals	18 " "

All these posts can be kept on hand under separate covers in two-inch lengths, and threaded the full length. The receptacles can be marked upon the outside so as to indicate the contents.

And the following few simple rules must be remembered in connection with the use of posts:

First: The post is to aid us in making the artificial crown base and root one continuous member, the cement being the intermediary agent.

Second: The longer and stouter the post (within limit) the greater the area of contact surface and the greater the resistance to stress.

Third: The length of the post should be at least two-thirds the length of the root, and additional contact surface is obtained by threading the post.

Porcelain Crown.

The artificial crown to be used must possess as nearly as possible the appearance of a natural tooth. The best results are obtained by using a Davis crown of proper shade and somewhat larger body, and grinding it into position, using the teeth in the mouth as the model; or an English crown of Ash make, also of larger size than required.

The first-named crown has undoubtedly a most favorable place among artificial dental adjuncts; although in harmony to its adjoining natural members, it is superseded by the peculiar effect produced in certain lights by the English porcelain. With these English teeth one sometimes obtains results in harmony which are almost uncanny, when we realize that they are, after all, but artificial substitutes.

The properties of the gasket must be such that, once given its shape in the Taggart machine, it must be rigid enough to resist any change of form which may be induced upon a softer or yielding one by the stress of the opposing teeth.

Preparation of the Root Canal and the Root End.

With small carborundum stones held in the handpiece of the engine, the lingual part of the enamel of the tooth to be crowned is removed and the dentine exposed. A saucer-shaped depression is thus produced, the depth of which is increased with the aid of a medium-sized round burr, to be followed by a smaller-sized one, until the patient reports sensation. The rubber dam is then adjusted and the teeth dried with a little alcohol and a blast of hot air gently applied. A sharp Butlerock drill of medium size is then allowed to penetrate the intervening dentine structure until a puncture is made into the pulp chamber; another gentle blast of warm air and the tooth is ready for the pressure anæsthesia.

In case of an upper tooth a small pellet of cotton is moistened and placed in the cavity, to which the moisture is thus transferred; the cotton is withdrawn and one pellet of neurocaine, one-twelfth of a grain, is placed in the cavity. By virtue of the moisture contained therein the drug is dissolved and by capillary attraction it is caused to travel toward the pulp.

A piece of black rubber, unvulcanized, is so shaped as to more or less correspond with the cavity in the tooth to be crowned. It is placed in the cavity and with a ball burnisher of suitable size pressure is exerted upon that part of the rubber, which, in order to act as a plunger, is allowed to remain as a surplus outside of the cavity.

The drug is then forced into the pulp tissue and anæsthesia is induced without causing the patient any appreciable degree of discomfort. The opening into the pulp chamber is then enlarged so that direct access may be had to the pulp canal.

The cavity is now freely washed with a solution of bichloride 1-250, and a barbed Donaldson broach is gently forced up into the pulp canal until the apex is reached; it is turned once upon its long axis and withdrawn, usually carrying with it the major part of the pulp tissue previously contained in the canal.

In the case of a lower tooth the procedure is the same, except that the cavity is not moistened before the pellet of neurocaine is placed. The latter is put into the cavity immediately following the gentle blast of warm air, and a drop of water (sterile) is placed upon the pellet after it rests in the cavity.

The cleansing of the root canal is continued until all of the pulp tissue has been extirpated; a dressing of tricresol and formaline is sealed in the pulp chamber and the patient is dismissed, to return in two or three days.

At the next sitting the rubber dam is applied, the pulp dressing is removed, the chamber and pulp canal cleansed first with alcohol, which is followed by a bichloride douche 1-250; the canal is thoroughly dried and the apical end of it is filled with a small piece of gutta-percha in the following manner: After thoroughly drying the root subsequently to the bichloride douche, a smooth Donaldson broach or a fine pulp canal explorer, around which has been wrapped a piece of cotton, is dipped into Eucalyptal Compound (Lilly) and carried into the pulp canal well up to the apex, so that that part of the canal becomes moistened with the compound; the larger end of a gutta-percha cone is now carried upon a ball end root canal plugger, and by repeatedly turning it upon its long axis it is firmly sealed into the apical portion of the root canal.

The remaining unfilled part of the canal is now reamed out with a reamer or burr of the proper diameter, so that the threaded post to be used will just comfortably slide in and out, and the orifice of the root canal is enlarged by slightly beveling it toward the occlusal surface. The preparation of the root canal of the tooth to be crowned is now complete, and the proper formation of the root end is now brought about by so

shaping it with the aid of fissure burrs and stones that a bevel is produced, each line of which forms an obtuse angle with some line upon the gum surface surrounding the root, and the extent of the obtuse angle should be inversely proportional to the stress exerted against that side of the root (Fig. 5, *a* and *b*). In other words, assuming that the root is that of a right upper cuspid, then the greatest stress exerted against it would be from within, out and forward, as well as from within, out and backward, or linguo-disto-labially and linguo-mesio-labially, and hence

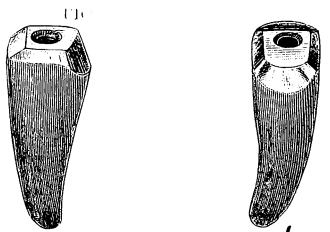


FIG. 5.

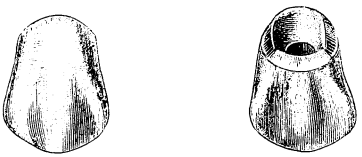


FIG. 6.

the angle produced by the line of surrounding gum and the line of bevel would need to be an obtuse angle of no more than 100-110 degrees.

Whereas, if the root to be crowned were that of a right upper central the greatest stress exerted upon that would be direct linguo-labially, and the angle produced by the gum line and bevel line at that point would need to be an obtuse angle of no more than 100 degrees. The point of the next greatest stress upon a right upper central is directed linguo-disto-labially or palato-disto-labially as well as linguo-mesio-labially, or palato-mesio-labially, and the angle produced at the junction of gum line and bevel line at these points may be an obtuse angle of 110-135 degrees, etc.

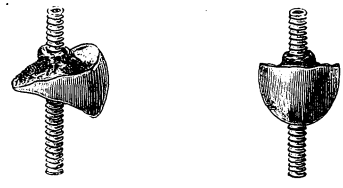
Upon examination of this method of preparation of the root end it will become evident that a bevel thus produced with varying obtuse angles will give increased contact surface, and hence increased resistance to stress, as well as absolute protection against splitting of the root, and will also effectually prevent rotation. It must be evident that rotation would only be possible if the obtuse angle produced by root and bevel were of the same degree all around the root.

One other advantage of this over the method of preparing the occlusal portion of the pulp canal in an inlay cavity shaped manner is that the integrity of the root is never made doubtful; both methods are inlay methods; the one described here is the bevelled end, external or over-

fitting inlay; the one referred to is the sheer walled cavity preparation, or inner fitting inlay. Upon close examination of all factors involved the one described here seems the safer to use.

Preparation of Porcelain.

The porcelain crown to be used in the restoration having been determined upon, it is so ground with the aid of small carborundum stones that it will approximate the root end upon the labial or buccal surface, as the case may be, while the rest of its base is stoned down and so bevelled that the obtuse angles produced at the various points will correspond, or nearly correspond, with the angles upon oppo-



a *b*

FIG. 7.

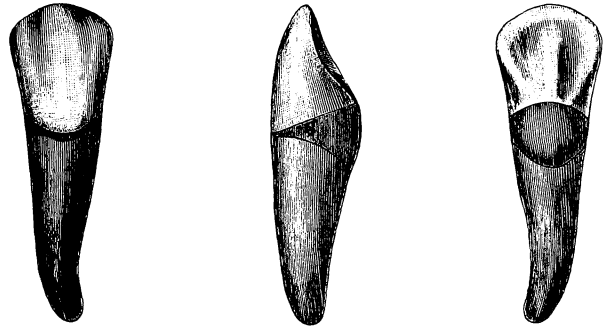
site sides of the root end, except upon the lingual surface, where the bevels correspond as nearly as possible. The post-hole in the crown is now bevelled lingually so as to obtain a sloping shoulder, which in conjunction with the post acts as a guard against labial or lingual displacement. The crown, which has been ground to the correct proportion, is now polished with sandpaper disks, using the carborundum disks first and following those up with coarse cuttlefish (Fig. 6, a and b).

A threaded post of the required gauge and of sufficient length is now placed into the root, and crown and root are brought into alignment. Should the position of the root demand it, the post may be so bent as to accommodate any difference of direction on the part of the root and crown. The crown is removed from the post; a drop of water is allowed to moisten the hole within it, as well as the base around it. A very small piece of beeswax is now placed into the hole of the crown and it is forced onto the post again.

By carefully manipulating the crown it will come away with the post in its proper position. With a hot spatula a button of inlay wax is gradually built up upon the gingival surface of the crown and also attached to the post. A hot instrument will soften that surface of the inlay wax which is to approximate the root end, and the crown, carrying the wax and post, is forced into the root until the labial surface of the

porcelain crown touches the labial part of the circumference of the root end. With right and left burnishers the wax is firmly forced against the root and with the proper carvers the wax is trimmed until it has assumed the form required. A stream of cold water is directed upon the fixture and it is removed from the mouth. A blast of cold air dries it, and will disclose any inaccuracy which may be present. More wax may be added and the former procedure repeated until the desired result is obtained (Fig. 7).

The root is now dried with a blast of cold air and a post of gutta-percha base plate is forced into it. Care must be taken that there be



a *b* *c*

FIG. 8.

enough surplus of gutta-percha so that it will well cover every part of the root end bevel, and even force the gingiva up beyond the bevel line, so as to insure a free field for the operation of cementation when the crown shall have been finished. The crown, carrying a wax gasket and post, one part of which gasket absolutely fits the root end, while the other fits the crown end equally well, is now placed into cold water and the crown may in a few minutes be easily separated from the post, which latter will cling to the gasket (Fig. 7, a and b). This post, carrying wax gasket, is now invested in the casting compound, care being taken to avoid all air bubbles, and after properly drying the mass and burning out the wax it is cast in a Taggart machine.

In casting this gasket it is well to use an alloy consisting of 456 grains of pure gold and 27 grains of 10 per cent. iridio platinum. This alloy is made in the same manner as those described in a previous article of the series. When the casting has cooled somewhat it is chilled, removed from the investment, brushed as free from silica as is possible,

and thrown into hydrofluoric acid and allowed to remain until all traces of the silica have disappeared. It is then removed from the acid and boiled in a solution of sodium bicarbonate and water.

If all steps outlined above have been carefully followed the crown will go to place upon its side of the gasket without any trouble. The surplus of casting material may be removed, the gasket ground down at that point and generally finished with coarse sandpaper disks, followed by cuttlefish, and subsequently crocus disks, and crown and gas-

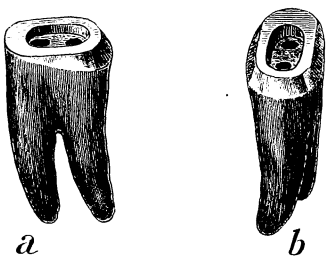


FIG. 9.

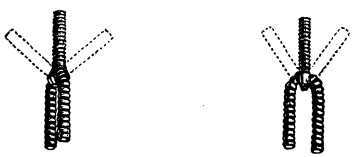


FIG. 10.

ket may be made into one continuous member, with the cement as intermediary agent (Figs. 6 and 7).

At the next sitting the gutta-percha packing is removed, the root thoroughly washed and sprayed. The cement slab carrying powder and liquid is in place; the instruments and jiffy cement tubes are ready. The cotton rolls are applied to keep the area thoroughly dry; the root is carefully and thoroughly washed off with a solution of bichloride 1-250, and this is followed with an alcohol bath; it is dried with a blast of warm air. The cement is spatulated until it has attained the proper consistency; the jiffy cement tube is filled with the contents forced up into the root canal; the post and root end of base are now covered with cement and the crown-post is guided into the root and gently forced to place (Fig. 8). It is held here until crystallization of the cement has begun, and care is taken to keep the area dry during this entire operation. A frequent change of cotton rolls is necessary to effect this, and the saliva injector must be in position all the time during this session. When the cement has set the surplus is removed, the surrounding gum is sprayed with warm water and briskly massaged for a few moments, and the patient is dismissed.

In the cases of the small anterior root canals where small posts must be used, or in the cases of bifurcated roots, the inlay wax must be allowed to enlarge that part of the posts which are to fit into the crown. In this manner the size of the smaller posts may be increased

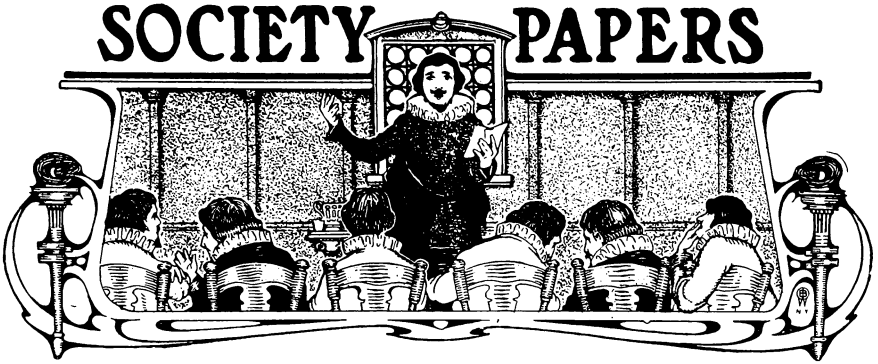
as required, the place of the wax being taken by the gold and iridio platinum alloy when the base is cast.

Posts for Bifurcated Roots.

The posts for the bifurcated roots (Fig. 9) may be constructed as follows:

A piece of threaded post 16-gauge, of sufficient length to fill both canals and reach across, is so bent upon itself as to form a staple (Fig. 10) which will comfortably engage both root canals. A small piece of 12-gauge threaded post is flattened at one end and a hole is drilled through the flattened end so that it may be slipped over the 16-gauge post down to the center of the staple (Fig. 10). The 12-gauge post is now reduced in length until it is of proper length not to interfere with the proper buccal approximation between crown and tooth. The wax, which is subsequently placed upon the crown in order to form the base, will engage this staple-shaped post and fix the small end in its proper position, while after the base has been cast it will be found that the double post for the root canals plus single post for the crown are to all intents and purposes one continuous piece.

SOCIETY PAPERS



Beginnings of Pyorrhea Alveolaris—Treatment for Prevention.

By G. V. Black, M.D., D.D.S., Sc.D., LL.D.

Read at the Annual Meeting of the Second District Dental Society, Brooklyn, Jan. 8th, 1911

During recent years, or since the publication of the *American System of Dentistry* in 1886, I have said but little of the pathology of the membranes and soft tissues about the teeth, but have devoted my written thought to other matters; more especially to the development of truer ideas of dental caries and the treatment best calculated to limit its ravages.

When writing the papers for the *American System of Dentistry* I was deeply impressed with the general lack of exact information regarding the histology and functions of the tissues connecting the teeth and the alveolar processes, or bones, and especially with the lack of direct knowledge of the powers, in processes of repair, of the particular tissues concerned. These physiological processes are properly the basis upon which all curative measures must rest if they be otherwise than empirical. At that time I made an effort to determine this by the examination of the tissues in question. These studies were published in book form under the title, *The Histological Characters of the Periosteum and Peridental Membrane,* in 1887.

Later, this histological work was taken up by Professor F. B. Noyes, with improved laboratory equipment for such studies, and with the aid of photomicrographic representation. By these means this part of the work has been pushed to a high degree of efficiency. Therefore at the present time, with the exception of a few of what seem to be points of minor importance, the minute anatomy of the parts concerned, and also

the physiological powers of each of the separate tissues, are understood by those who have given the subject close attention.

But a very long and tedious testing out clinically of the ideas obtained in the work in the minute anatomy in their relation to physiological processes, as these latter are related to healing processes, and to the restoration of lost parts, or badly mutilated parts, was essential. These could be made but very slowly by the careful following of cases and noting of results under a large variety of conditions. In a good degree this work has been done and we are in a position for a more rational consideration of the general features of the pathology and treatment.

In this connection a very considerable reservation must still be made, because we have not yet been able to make accurate laboratory studies of the progress of disease in these particular tissues in the human subject. Such examinations are among the most delicate of histopathological work, and practically no material obtainable from the ordinary sources can be had in condition to be of value for such studies. Yet without this the histological work, aided by the studies of the physiological processes and the powers of repair of the separate tissues involved in pathological processes, studied by the close following of results in clinical observation, has added so much to our knowledge that it seems to merit a restatement.

Special Pathology of Tissues about the Teeth.

The tissues connecting the teeth with their associated parts when considered with reference to their physiological functions, in the support and protection of the teeth, cannot but have a pathology as peculiarly their own as caries of the teeth has a pathology that is unique. To understand the significance of this pathology and of its possible results, one must have, as a basis of observation and of thought, an intimate knowledge of the histological and physiological relations of the membranes and gingivæ to the teeth. There is nowhere else to be found such relations of contiguous and mutually dependent tissues as exist between these.

The soft tissues immediately about the teeth exist for the support and protection of the teeth, and have special relations to them for these purposes, and it is for the most part disturbances of these special relations that give their pathology its particular significance, which has rendered its results difficult to understand.

To the more common observation, these soft parts respond to injuries or to irritations by inflammatory movements, suppurations, etc., similar in kind and form as seen in other soft tissues supplied with blood-vessels, nerves, lymphatics, etc. They are also affected promptly

by certain medicines taken into the circulation, as salts of mercury, iodin, etc., and probably by some of the disturbing bodies resulting from faulty metabolism not yet accurately made out. The peculiarities of their histological relations with the teeth, and their function of support and protection to the teeth, cause these disturbances to give results not found elsewhere.

Connecting Tissues.

The connecting tissues forming the attachment of the teeth are the septal tissues and the gingivæ in general, the peridental membranes, and the alveolar processes. The function of these is primarily the retention of the teeth in position, and secondarily, the preservation of the health of the parts. The gingivæ include all of the tissue which is superimposed upon the margins of the alveolar processes and attached to the teeth. They rise about the teeth and invest the gingival portions of their crowns, terminating in a free or unattached border. The subgingival space is between the free border of the gingivæ and the tooth. For convenience in designating parts, that portion of the gingivæ resting upon the alveolar septum of any two teeth, which rises to fill the interproximal space, is called the septal tissue, or septal gingivæ. These parts of tissue join the gum tissue, which covers the alveolar processes to their crests, without demarkation. They also join similarly with the peridental membranes. When normal, the septal tissue and the gingivæ lap onto the gingival portion of the crowns of the teeth, and so fill the interstices between them and about them as to preserve their cleanliness in the best possible manner in an unusually difficult environment. This latter is one of the important functions of this tissue that must not be forgotten nor treated lightly in any consideration of the function, or of the pathology, of these connecting tissues.

These tissues exist only for the attachment of the teeth and the preservation of their cleanliness and health. In this sense they belong to the dental apparatus as true appendages to the teeth. If the teeth are removed, as by extraction, these appendages, including all that is termed the gingivæ and septal tissue, and the alveolar processes, as such, are removed by absorption, as being of no further use in the economy. There remains only a bony ridge covered with ordinary gum tissue.

The Gingivae.

In the young person the free borders of the gingivæ are very long, covering a large part of the crowns of the teeth. As age advances the teeth protrude more and more and this free border becomes shorter. This shortening is rapid until the person is about twenty years old—

that is, until the gingivæ are fully formed. However, there still remains a tendency for the free borders of the gingivæ to slowly shorten as age advances, exposing more and more of the crowns of the teeth. In old persons the free borders of the gingivæ are inclined to become very short.

The special function of the gingivæ is to form the connection between the teeth and the superficial soft parts, and with the peridental membranes and alveolar processes. Incidentally as it might seem, and yet another very important function, is to fill out all interstices about and between the teeth, and to smooth up all irregularities of surface for the prevention of the lodgment of food particles, or debris. This special tissue, therefore, when in good form, serves the purpose of cleanliness especially well. When over abundant, insufficient, or irregular in surface form, the difficulties of maintaining cleanly conditions are correspondingly increased. The gingivæ should be studied not only with relation to possible pathological conditions, but also, and especially, with relation to form and the influence of irregularities of form on the maintenance of cleanliness and health.

The Septal Tissue.

The septal tissue, when normal, fills the interproximal spaces to the contact points between the several teeth. When this tissue is in good form it fills out the interstices between the teeth in such manner that food stuff crushed upon it glides over its surface without lodgment, injury, or sensations of pain. This is true even when the food is very rough and impelled over the surface of the tissue with great force in heavy chewing. To meet these demands this part of the tissue is very tough and elastic, and is fitted for this heavy usage.

Attachment of the Soft Tissues to the Teeth.

The attachment of the soft tissues, the gingivæ, the septal tissue and the peridental membranes to the teeth, is peculiar to these structures. The attachment of these to the crests of the alveolar processes is similar to the attachment of the soft tissues to the bones in general. The peculiar conditions of the attachment to the teeth are due to the peculiarities of the tissue to which the attachment is made, the cementum, which has no power of self repair. This constitutes the important feature.

The tender point, therefore, is the repair of the attachment of these tissues when separated from cementum; for we have seen under functions of the connecting tissues, that if this attachment fails, or is permanently severed from any cause, all of the others fail as a result.

Whenever, from any cause, the gingivæ or the peridental membrane is detached from the cementum for a space, new cementum must be laid down upon the old and builded into and around the ends of the principal fibers of the peridental membrane, to form a new attachment.

The Cementum.

The cementum is in a degree continuously growing through deposits laid on from time to time by the peridental membrane. Slight or even considerable injuries to the attachment caused by movements of the teeth are readily repaired by building on new layers as needed. In youth the cementum is thin and may remain rather thin if there have been no disturbances. We much oftener find thick cementum in older people. In these, careful search shows that in many places the fibers of the peridental membrane have been detached and again reattached by the building of a new layer of cementum. Also, considerable absorptions occasionally occur, cutting away the whole thickness of the cementum, and going deeply into the dentin. Neither of these tissues has the physiological power of self-repair in any degree. When such injuries are repaired, they are repaired by being filled in with a deposit of cementum laid down by the peridental membrane.

It is not impossible that in case of a clean incised wound detaching the gingivæ, the old cementum, or possibly cells remaining attached to it, may take part in forming a reattachment; for we know from abundant clinical experience that incised wounds of this character heal promptly, much as other simple incised wounds. But in case of infected wounds it is different. The cementum has but very slight vitality, which is maintained by its cement corpuscles. These are very like the bone corpuscles. But there is this very important difference—in the bones they have the Haversian canals and the circulation of red blood to support them; in the cementum there are no Haversian canals and no circulation of red blood. In the cementum the support is derived directly from the peridental membrane. In case of the separation of the membranous covering from the cementum, the continuance of its vitality must be brief. If a reattachment occurs, it must be by building new tissue onto the old by a process of deposit. Therefore a reattachment after a complete detachment from the cementum and its exposure to the fluids of the mouth, or to the infectious material of pus pockets, is a very different problem. While some well observed cases of reattachment, or a limited growing up of the tissue onto the previously uncovered area of cementum, have occurred under such conditions, clinical experience shows conclusively that it is seldom to be expected.

Replantations and Implantations.

Replantations and implantations of teeth have occasionally been made for a hundred and fifty years. Implantations in which a stranger tooth is set into a socket artificially made in the alveolar process to receive it, or planted in the socket of a tooth recently extracted, have had trial dating back a century and a half. The roots of such of these as became attached and seemed to do well for some time have generally been absorbed within from two to five years, and the teeth have been lost. The observed facts therefore indicate that an attachment may occur, not only to the root of a tooth that has long been dead, but that this reattachment may also occur in a surgically made socket in the absence of a normal peridental membrane. All such reattachments have, however, been only temporary. All seem to have been destroyed in the same way, namely, by absorption. After the development of antiseptic or aseptic work there was great hope that these operations could be made permanent. They have, however, generally been only temporary successes. The absorption of the root has been the rule to which only an occasional exception has occurred.

The lesson from replantations and implantations is conclusive in showing the possibility of the reattachment of the soft tissue to tissues wholly devoid of vitality, and that this will occur with a fair degree of regularity under reasonably aseptic conditions. The attachments, however, are incomplete, so that many small areas are left, and from these absorptions radiate, which sooner or later destroy the root of the implanted tooth.

Detrimental Influence of Antiseptics.

It now seems probable that a considerable element in the failure of implantations in recent time is due to the antiseptic used to sterilize the implanted tooth. Recent developments seem to show that asepsis is highly important, but that no antiseptic should be used in the prepared socket, and also that all of the antiseptic used to sterilize the implanted tooth should be dissolved out before it is placed in the socket. This is for the reason that any antiseptic interferes with the process of repair.

The planting of a sterile, stranger tooth in a clean, surgically made socket gives a far better opportunity for attachment than can be had in pus pockets by any treatment known to us.

Certainly this history gives little hope for the reattachment of soft tissue to the exposed roots of teeth in pus pockets where aseptic work is impossible. If in these cases we attempt to use antiseptics to pro-

duce a better field, the drug used will in itself so poison the tissues as to produce a negative result.

These considerations of the physiology and pathology of the tissues in question should lead us to adopt measures to prevent detachments of the gingivæ and the peridental membrane rather than risk efforts at cure of the condition after its occurrence. When detachment has occurred, such amelioration of conditions as will prevent the detachment going further, and such healing as will give comfort and a fair degree of usefulness of the organs involved, is probably the best we will ever be able to do. This statement seems to be justified by studies made up to this date. What the future may bring cannot be predicted.

The Pressure of the Contact Points of the Teeth upon Each Other.

Any dentist of even a few years' experience cannot have failed to notice that when a tooth is removed from the arch, the space it occupied soon becomes considerably narrowed by a movement of the teeth on either side toward each other. Careful observation shows that the principal movement is in the tooth distal to the vacancy. The younger the person, the greater will be the movement. If a tooth is decayed in a proximal surface so much that a proximal contact point is lost, the two teeth drop together until the tooth not decayed enters more or less into the cavity of the decayed one. Also, if both teeth are so decayed as to permit it, the two teeth are apt to move toward each other until they come together at their gingival lines. This obliterates the gum septum and the alveolar septum is much narrowed by absorption. These movements of the teeth, though they become slower and less extensive as age advances, are observed at all times of life.

These movements occur through a tendency in the peridental membranes to continuously draw the teeth against each other in the line of the arch, and to hold their contacts tight, and resistant to the passage of food between them into the interproximal space, so long as the arch is complete. There is in the forces exerted by the peridental membranes a subtle arrangement by which the fibers are continuously drawing the teeth toward each other for the preservation of the solidity of the arch. So long as conditions are otherwise normal, this solidity will be maintained. There are certain conditions, however, that interfere with this force in a remarkable degree. In any general tumefaction of the gums in which the peridental membranes take even a small part in the inflammatory movement, their fibers loosen their grasp and give the teeth unusual motion in their sockets. These, briefly stated, are the important matters we must reckon with in any treatment

of conditions involving a danger of a separation of the attachment of the soft tissues to the teeth.

Injuries to the Septal Tissue and Gingivae.

Injuries to the septal tissue and gingivæ, other than those caused by calculus, occur in various ways, among which are the following.

(1) Crushing food through between the contact points in chewing and crushing the septal tissue.
(2) Pricking the septal tissue or the gingivæ with slivers from infected wooden toothpicks.
(3) Lacerating the septal tissue or gingivæ with sharp edges of bones and other substances accidentally in food.
(4) Injuries to the attachment of the gingivæ by ligatures and other accidents in filling teeth.
(5) Other accidents to this tissue not classified.

It now seems to me very curious that the dental profession has so long ignored this class of injuries to the septal tissues and gingivæ. In other words, these injuries have not been recognized as being the origin, or starting points, of grave disease recognized later. When I state that I am finding a large proportion, two-thirds certainly, of the grave conditions of the peridental membrane, starting from these local injuries to the septal tissues or the gingivæ, and capable of radical cure if noticed in time, I am certainly not overstating the facts. The large majority of these injuries occur because of faulty contact points, many of which are made by the dentist in filling proximal cavities. A considerable number of them occur, especially in middle-aged or older people, who have, otherwise, very good teeth, from excessive interproximal wear of the contact points. The remainder may be said to occur from accident, and may occur at any age.

The septal tissue is so constituted that it will bear a great amount of abuse. Its position and function require this. When properly formed, and reasonably protected by normal contact points, the food that is crushed into the embrasures glides over the surface of the septal tissue with great force, without injury or painful sensations. Under conditions of irritation the septal tissue often reacts in the form of very extreme sensitiveness, so much so that the slightest touch causes pain. In other cases of irritation, or of considerable inflammation, there seems to be a reverse condition—that of paralysis of sensation to what would normally be painful impressions.

In the beginning of the leakage of food into the interproximal space, there is usually annoyance because of the presence of the food rather

than from a sense of pain. If the impaction of food against the tissue continues, one of two things happens. There is developed a tolerance of impacted food, or an extreme sensitiveness and pain that leads the patient to seek relief. But often instead, persons will guard against chewing on that side of the mouth until the sensitiveness abates. Then, upon re-beginning the use of the lame side, the same experience is repeated. This occurs again and again. In this way the septal tissue is gradually injured more and more.

The reactions of the tissue during this process vary indefinitely. In a considerable number of cases there are almost no painful phenomena, and slowly the septal tissue is crushed out and destroyed. Then the alveolar septum suffers the same fate, and the peridental membrane is destroyed further and further along the side of the root, until the tooth, from sheer lack of support, becomes too lame to bear the force of mastication. This is probably the most hopeless class of cases, because such cases become incurable before they are recognized.

In other cases the reaction of the tissue is entirely different. Instead of a slow absorption, the tissue is forced out into the embrasures in festoons that partially, or completely, fill the embrasial spaces, even to the level of the occlusion. These are very red and inflamed, but usually give but little pain. They bleed frequently from injuries by food. Finally the tissue sloughs away and is destroyed. The destruction of the alveolar septum and the peridental membrane follows. This class of cases is seen mostly in young people from eighteen to thirty years old.

Septal Abscesses.

In a third class of cases the patient is in serious trouble from the beginning, and makes frequent appeals for relief. If I should form a judgment from what I have personally seen, I should say that up to the present time their calls for relief are in vain, except from a comparatively few operators, for they tell me that they have been to their dentists, who have told them it is nothing of consequence and will soon pass away, or that nothing can be done. A certain small proportion of such cases develop septal abscess some time in the early progress of the trouble. These are generally very painful affairs, causing the patient to seek relief. I have been much surprised within the last few years by the number of these sent me for diagnosis and advice as to treatment.

In septal abscess the septal tissue is swollen, sore and very painful. In many of the cases the patient refers the pain to the teeth, one of which is generally much more painful than the other, though both may be painful to pressure. Inflammation and redness spreads considerably to the neighboring tissues, and especially to the peridental membranes. Often such cases simulate alveolar abscess very closely and are mistaken for

that condition. In one case sent to me for advice some time ago, the dentist had cut into and destroyed the pulp of—first, the first molar, which he found alive, then the second bicuspid, then the second molar, and finally the first bicuspid, in his effort to find the cause of what to him appeared to be alveolar abscess. When I saw the case the abscess was just showing a disposition to point on the gum to the lingual side. I discharged the pus with a knife at once, which gave relief from the intolerable pain. I then traced the abscess clearly into the septal space. As the tissue became limp after the discharge of the pus, I was able to pull away a mass of partially decomposed food débris crowded far onto the alveolar septum between the septal tissue and the broad, flat, mesial surface of the first molar. Much of the alveolar septum between the teeth had been absorbed and destroyed, and the pus pocket had occupied the space, leaving the remains of the septal tissue without support. The attachment to the first molar was broken down under all of the central part of the septal portion. In this case neither the septal tissue nor the absorbed alveolar process would be restored, and after the shrinkage of such of the soft tissue as would remain alive, the interproximal space would stand wide open. This, though a very bad case, especially in the vigor in which the search for a tooth with a dead pulp was prosecuted, is typical of many cases seen.

As has been said, the septal tissue rapidly recovers from severe abuse. It may be cut and lacerated badly, and yet recover fully. Much of its bulk may be absorbed by pressure, and yet in young persons and under favorable conditions, complete, or nearly complete, recovery of its former bulk may be expected. But detachment of the tissue *en masse*, or its general destruction by crushing out, does not permit of anything like complete recovery. A scar tissue, small in amount, only partially filling the interproximal space, may replace the former full septal tissue, but it will ever afterward be a lame spot, and difficult to keep clean.

When, however, an abscess has occurred in the septal tissue and has been allowed to run its course, the rule is that recovery is not to be expected. This is especially true if there has been a detachment of the tissue from one or both teeth for any considerable space, or a marked loss of the alveolar septum by absorption or by necrosis. In this case a scar tissue covering over the injury without material filling of the space must be regarded as a happy result. In cases in which the peridental membrane has been destroyed for a sufficient space to form a permanent pocket along the side of the root of the tooth, permanent healing generally fails. Whatever we may do, this pocket will fill with infectious material, pus will again form, and the case grow worse and the pocket deeper, with each inflammatory movement.

Lateral Alveolar Abscess.

A lateral alveolar abscess is one occurring on the side of the root of a tooth within the alveolus but not involving the apex of the root of the tooth. The pulp of the tooth may be alive and remain so. They are similar both in their causation and in their symptomatology to septal abscesses. Also they occasionally occur instead of septal abscess, or as a sequel to this condition. This abscess is liable to occur under any condition in which there is a break in the continuity of the attachment of the soft tissues to the neck of the tooth, permitting infection of the peridental membrane. In the literature there are some descriptions of this abscess in which it is said to occur, especially in gouty individuals, as an original affection, or without previous injury or suppuration detaching some portion of the gingival attachment of the soft tissues. I have not, however, met with any case in which evidence of previous disease or mechanical injury was not apparent.

But a large proportion of the cases beginning in such injuries pass on to the parting of the soft tissue from the teeth without the formation of anything that may be termed septal or lateral alveolar abscess. Many of these seem to cause the patient little inconvenience in their earlier stages, and ordinarily when discovered are recognized as deep pus pockets beside the root of one or more teeth.

Injuries Caused by Ligatures.

Cases occurring from other causes than faulty contacts are frequent. Most of these are from accident of one kind or other, as mentioned in the beginning. Among these, injuries by the ligature in placing the rubber dam are occurring frequently, especially to the upper incisor teeth. In these teeth, as is well known, the attachment of the tissues to the gingival line is in arched form from labial to lingual, and is especially liable to laceration by ligatures. A couple of years ago, while demonstrating the placing of the rubber dam before a class, I called a student to the chair to act as a patient. I noticed something wrong with his upper incisors, and after a momentary examination turned to the class and said: "This student has had the attachment of the soft tissues to the upper incisors so injured by ligatures that they will never recover." I then asked the young man to tell the story of the injury to the class, which he did, corroborating my statement. His story was that it had been four years since the injury was inflicted. At the time of this examination there were deep pus pockets on the proximal sides of the roots of all of these teeth, the alveolar septums were absorbed, and the septal gingivæ had dropped into the spaces, leaving the interproximal spaces empty. Much too many similar cases are occurring.

Less extensive injuries to the gingivæ and septal tissues are occurring

from other accidental causes, as from leaving bits of rubber dam between the teeth, from splinters of infected wooden toothpicks forced into the tissues, broken fragments of fish bones in the gingivæ, and many other similar injuries. Any such that produce even a slight suppuration are liable to break the attachment of the soft tissues to the tooth, and develop pus pockets.

Spreading of Disease from Injuries.

Many of the slighter injuries to the gingivæ and septal tissues heal by first intention without pus formation, though in a region continuously infected. Indeed the great majority of such injuries heal in this way, leaving no mark of having been inflicted. This occurs with such frequence that dentists pass them by without thought of their seriousness in case pus forms in the subgingival spaces about the teeth. A cut of the attachment of the gingivæ is made by drawing a ligature through a contact point; next day all signs of this have disappeared. But in some of these trivial injuries pus forms and affects seriously the attachment of the soft tissue to the tooth. Often a ligature is placed without previous cleaning of the margins of the gingivæ, and carries with it a mass of microörganisms into the tissue, which is lacerated and compressed for the time in which a filling is being made. Such a case is very apt to suppurate. It may still get well, but often it does not get well, and especially if the attachment to the cementum has been broken the case is liable to become chronic and the suppuration continue, at first as a slight pus pocket, but one that continuously grows deeper.

Movement of Diseased Teeth Spread Disease.

It is a rule in the pathology of the peridental membranes that when disease, such as a pus pocket, has attacked a tooth upon one side, there is a tendency for that tooth to move away from the diseased side. It is difficult to place sufficient emphasis on this well observed fact or upon its results. This may cause the tooth to leave the line of the arch or to press against other teeth. This tends directly toward interference with the occlusion, and quickly interferes with neighboring contact points, and other foci of irritation or inflammation, trivial at first, are set up. These in turn become pus pockets; each of these cause more interference with the occlusion and with still other contact points. Then the tendency to the general spread of the condition through the mouth has begun. In this way the formation of a single pus pocket as a beginning will often cause the demoralization of the occlusion, derange the contact points, and involve the septal tissues and gingivæ in suppurations and pus pockets that bring ruin to the whole denture. These come about slowly and without notice often, until they have passed to an

incurable stage. In this way a single break may, and often will, lead to the destruction of the best set of teeth. It is in such injuries that the beginnings of the large majority of serious cases of pyorrhea alveolaris occur.

Examinations of the Gingivae.

Ocular Examinations. In order that the dentist may prevent grave disease affecting the attachments of the soft tissues to the teeth of patients for whose welfare he is responsible, he must be forever looking for the beginnings of these troubles. This habit must be so formed that he will automatically look after this matter at the first examination of any person who has been absent from his observation for a few months. In no other way can he escape being occasionally surprised by the discovery of grave lesions that have occurred, practically before his eyes, without notice. The rule should be to always look over the gingivæ and neighboring gum tissue for suspicious spots of redness, and if any such are seen, to at once investigate with the view of finding the cause. To this end all parts about the teeth should be brought successively under the eye directly, or by use of the mouth mirror. The order of doing this may not be important, provided some regular order be adopted that will include all of these tissues.

The particular things looked for will be over-fullness of the gingivæ in children and young persons in general. In these a bit of extra redness of the septal tissue, especially if there is also some apparent swelling, with an inclination to festooning into the embrasures, lead to a suspicion that lodgments have occurred in the septal space. Then a special examination will clear up the cause and lead to such treatment, if any, as may be necessary. Often such redness will point only to a lack of care as to cleanliness, and call for some drilling of the patient in the use of the means of cleaning.

In older persons such points of redness and swelling of the septal tissue, even though slight, will often disclose grave conditions, or imminent danger that such will occur, caused by the impaction of food between certain teeth that requires immediate treatment of the most vigorous kind, especially as to cleanliness, to prevent destruction of tissue. The patient may be totally unaware of the injury or of danger, or inquiry may bring out a history of only some annoyance, or, in some cases, of pain after meals, and inefficient efforts to remove lodgments with toothpicks. Sometimes an unnecessary toothpick habit has been formed, and injury is being done. In running the eye over the tissues, information is gained that leads to the investigation of any suspicious point, and the determination of the necessities that may or may not call for corrective

treatment. These conditions will be of the most varied kinds. Slight redness about the region of the gingiva leads to the exploration of the subgingival space for injuries to the tissue attachments.

Digital Examinations.

While ocular examinations will detect many of the troubles of the gingivæ and the gum tissues, there are some conditions of the gravest importance that the eye will not discover. Therefore, a look over the tissue is not enough for the safety of the patient. A well trained sense of touch will discover many things that will not be revealed to the eye. The two combined are necessary. The beginning of suppuration in the subgingival space may generally be discovered by a light pressure of the finger above the gingivæ, sliding down toward the free margin while this is in view. It will occur, more frequently than most persons think, that a drop of pus will be extruded by the finger pressure that will tell of the beginning of one of the gravest diseases to which this tissue is liable. Without this special form of examination, the disease generally will have become incurable before it is discovered. For this alone, if there were nothing more, every dentist should be continually, and as a kind of fixed habit, examining the gingivæ of his patients in this particular way. Just a few of these cases discovered in time to prevent grave injury will pay for any reasonable amount of this kind of examination. A little swelling, a little thickening of the gingivæ or the gum tissue, a bit of absorption of the alveolar process felt through the gum tissue, a little sensitiveness to pressure here and there, and many other things that cannot be told in detail, will be discovered by a well trained sense of touch. The sense of touch is also one of the best means of confirming or correcting suspicions of disease aroused by sight. It is often the case that some deeper redness of portions of the gum tissue or of the gingivæ will give a suspicion of disease, which the sense of touch will correct, and determine that the condition is not abnormal. Literally, the sense of touch is one of our best means of gaining early information of disease in order to give assistance when it will be most effective.

Instrumental Examinations.

Both the ocular and the digital examinations must often, however, be supplemented by instrumental examinations before a full diagnosis can be made. Also, there are conditions of the beginning of grave disease that cannot be found, short of instrumental explorations. One of these is the beginning of pus pockets on the lingual sides of the roots of the upper incisors. Generally the existence of this is not noticed until the teeth begin to move labially, and I find that even then many dentists have not recognized the cause. Disease begining in this position is covered with very thick, strong gingivæ, so that there is little or no

showing of it on the surface. It is so frequently pressed upon by the tongue that the small amount of pus forming is discharged at such frequent intervals that it will not be seen by the combined digital and ocular examinations described above. So soon as the labial movement of the upper incisors begins, it is followed by the other teeth—the bicuspids and molars—the occlusion is deranged, contacts are loosened here and there, and slowly and almost imperceptibly the whole denture is involved in ruin. Other conditions at special points in the mouth will be found that will not yield correct results without instrumental examination. These are therefore purely primary examinations, to be corrected or extended by other means in making diagnoses.

For the examination of the subgingival space in general, including that of the septum, a few special instruments are necessary. These are after the fashion of the push scalers, but with all angles slightly rounded and polished instead of square-ended, with sharp angles. The blades should be light and thin, and not more than one or one and one-half millimeters in breadth. The forms should enable one to explore the subgingival space fully around every tooth with facility. With these, and a fairly educated delicacy of touch, it should be easy to detect any break in the attachment of the soft tissues to the gingival line of the tooth, and determine the size and depth of the injury. It seems almost unnecessary to say that this examination should be very delicately made, for with so thin a blade as seems necessary to do this work well, injury to the attachment of the soft tissues may be made with slight pressure. With these instruments one may quickly learn whether or not there has been injury to the attachment of the soft tissue in any given case, as one of the most important things that should be known at the outstart in any examination for injuries to the attachment of the gingivæ. In a word, learn of the case in hand delicately and certainly in the first instance, and know, if possible, what the injury, if any, may be.

Notes on Treatment.

In cases of the intrusion of foreign substances, the first object is their removal. If abscess has already formed, it should be treated as other abscesses of the soft tissues, *i.e.*, drained of its contents and allowed to rest. In cases where there is much pus, the abscess should be thoroughly and rather forcibly irrigated with normal salt solution.

Cases giving much difficulty will occasionally occur. Often a little sliver from a wooden toothpick will evade the sense of touch distressingly. Bits of rubber dam torn away while removing the rubber, and left unnoticed, will occasionally cause sharp inflammation or an abscess, and

are ordinarily not discoverable by the sense of touch, and may give much trouble. This class of cases, however, forms much the smaller number.

Generally the cases will be found to be from the impaction of food in the septal space. If all calls on account of impaction of food be carefully investigated, the majority will be very simple. The examination may show considerable compression of the septal tissue and a reduction of its volume. Generally the lodgment will be central, or directly beneath the contact point, depressing that portion of the septal tissue in its entirety from tooth to tooth. This form is least dangerous, and if absorption is not very considerable, will generally, when relieved from repeated impactions, recover readily without other treatment. In case the impaction passes to one side, between the septal tissue and one of the teeth, the danger of injury to the attachment of the soft tissue to the tooth is greatly increased. If the attachment is uninjured all is well. Recovery on removal and prevention of further impaction is assured. In a considerable number of these cases there will be much irritation and swelling of the tissue, with festoons into the embrasures. This complication is unimportant except from the annoyance it gives. The condition is usually recovered from readily.

In all this class of cases the one thing to be done is to stop the repeated impactions of food, and protect the case against their repetition by securing firm pressure of the contact points one upon another. In this the good form of the individual contact points becomes a matter of first importance. If, after careful examination, it is found that the contact points are not at fault, the impaction has probably occurred primarily from some accidental wedging of food into the septal space. In this case the wedging of the food, the swelling of the septal tissue, and the resulting irritation of the peridental membranes, has caused a loosening of the pressure of the contacts upon each other, which has allowed the impaction to be repeated at each meal time, increasing the difficulty.

Furthermore, these impactions are apt to become multiple; the irritation has loosened the grasp of the peridental membranes on the contacts to such a degree that stringy foods are liable to pass any neighboring contacts they may happen to strike, complicating matters by the establishment of new foci of irritation. In such a case the most careful attention should be given, for the reason that it is from neglect of such simple matters that very bad cases of so-called pyorrhea come. The septal space, or spaces, should first be carefully cleaned. Then the patient should be made to understand the importance of special care as to cleanliness and the use of this part of the mouth in chewing food, for a time, to allow of recovery and the renewal of the normal pressure of the contact points upon each other, so that further impactions will not occur;

and especially, if by any means reimpaction should occur, that the space be freed from it at once. If in spite of these precautions the case should grow worse, a proximal cavity should be cut in the most favorable position, and the teeth propped apart with a gutta-percha filling until the membranes and irritated septal tissues have recovered. Then a permanent filling may be made with a contact sufficiently prominent to be secure against further difficulty.

If examination shows flattened contacts, whether from faulty forms of the teeth originally, because of interproximal wear, or from faultily formed contacts in making fillings, these should be made good as soon as irritation that may be present has passed. When there is no cavity, a suitable cavity should be cut. If it be a faulty filling, the filling should be removed, no matter how perfect it may otherwise be. This latter is demanded more urgently than if the filling was found leaky and decay beginning around it, but with the contact good. After cutting cavities, these may, for the time, be secured with carefully made gutta-percha fillings, upon which the patient may chew food without injury. Then the case may rest until the irritation has subsided and the tissues returned to the normal. In the meantime the slight spreading of the gutta-percha from the impact of food in mastication will secure much of the necessary separation for building a good and sufficient contact point. But one of the most important points to be attained by this plan of work is the recovery of the strength and tone of the peridental membranes, and the renewal of the grasp of the contact points, one upon another. This has been in a degree lost, or loosened, because of the irritation, or lack of sufficient use because of pain. One should never try to make a metallic filling or an inlay in teeth that are sore to the touch, or hypersensitive to the mallet.

Calculus.

Serumal Calculus—Pus-pocket Calculus.

Salivary calculus is a mixture of salts of calcium—principally phosphates—with small proportions of other crystallizable material united with some organic constituents. Under conditions not yet satisfactorily known, this material is deposited upon the natural teeth, artificial teeth, on plates, or any other solid placed in the mouth. One of the important well-known phases of this is that a solid is necessary to the beginning of the deposit. In the absence of a solid no deposit occurs on the mucous

membranes or other soft parts. If a precipitation of calcium salts occurs without a solid for its attachment, it is carried away by the saliva and lost.

The general facts regarding this deposit of calculus, the positions in the mouth where it occurs, etc., and the destructive character of this material when lodged in contact with the soft tissues, are so well known that I need not take up any time in presenting this phase of the subject.

I recognize three kinds of calculus as being found in the mouth—salivary calculus, the most general concretion; serumal calculus, which is lodged in the subgingival space upon the enamel or cementum, or upon both; and pus pocket calculus, which often is deposited upon solids located in pus secreting areas, especially on the roots of teeth where the attachment of the peridental membrane has been lost, but which are still enveloped by soft tissue. These terms are convenient as at once expressing the source and place of deposit of the calculus, and something of its general qualities. As to the intrinsic nature of the calculus, all are alike. The specimens vary in hardness, in color, in form, etc., but their chemical form and their physical form are otherwise the same in all these situations.

The salts from which the concretions are formed are all derived originally from the blood, body juices and tissues, whether the special field of deposit be from the saliva, the serum, or secretion, if you choose to so term it, exuding from the gingivæ within the subgingival space, or from the serous fluids of pus. All specimens agree in being made up of minute particles thrown out of solution by precipitation and united in solid form by agglutination. This suggestion of agglutination of the precipitated calcium salts by something derived from the saliva has appeared occasionally in the literature, but no one seems to have seen or described such a substance. I have found this substance by the careful examination of plates worn in the mouth, and watching for the first traces of calculus after each thorough cleaning.

Deposit Antecedent to Calculary Deposit.

The first proposition not heretofore generally recognized is that a colloid precipitate, inspissate or agglutinating substance, must first be formed and deposited upon the teeth, or other solid substance, before there can be a lodgment of the calcium salts. Then the precipitated particles lodge in this material. This agglutinating material is not soluble in running water, warm or cold. It coagulates and becomes white like the cooked white of egg at, or near, 200° Fahr. I have seen sets of teeth as white as paper and entirely invisible within this coating after having been subjected to boiling water, though such a complete covering is rare. When freshly deposited it is perfectly transparent, not obscuring the plate in any degree. It has a soft, greasy feel, and is

slightly sticky to the fingers. It is readily broken up and washed away with a brush and water. Nothing more is needed to clean the teeth or plate. If a particle of this agglutinating material when freshly deposited is taken up from the outer margin of the deposit—that containing the least proportion of the precipitated calcium salts, or often none—and conveyed to a cover-glass, and this pressed down on a glass slide in a globule of glycerin, and in this condition is examined with a good half-inch lens, the central portion will often seem to be without form elements. But around the margins it will usually be discovered that the agglutinating substance is in the form of small globules, oval forms or cylinders of irregular length, although this is sometimes difficult to bring clearly into view. At first these forms become more and more transparent from the effect of the glycerin. They finally, after some hours, break up into semi-crystalline forms that for a time refract light strongly enough to be clearly visible, though very transparent. Formalin hardens them; they become white in alcohol; when mounted in balsam they soon become too transparent to be clearly visible. They are seen to best advantage in water, but such mountings cannot be kept. The granules of calcium salts, which are so minute that the sixth inch lens is necessary to make them out well, become more and more transparent in glycerin or balsam until they become almost invisible, and finally are practically lost to view. They do not seem to dissolve.

Note. Since writing the above the investigations have been continued. The plan of gathering the material for study upon a cover glass held in the buccal surface of a dental plate (Fig. 3) with gutta-percha had been devised, but not much use had been made of it because of the difficulty of removing it safely and placing a new glass. This was improved by making a little frame of ordinary gold plate held by a screw at each end. Under this frame a bit of cover glass is held securely and removed without marring the deposit by removal of the screws. Another glass is then readily placed. I grind the ordinary cover glasses to fit the space. This has served for the collection and preservation of specimens in the exact form in which they have been deposited.

A space one-fourth by five-eighths of an inch made perfectly flat and sunk slightly below the general surface is abundantly large. This should be placed opposite the salivary duct. A piece of vulcanized rubber improvised for the purpose and securely attached to one or more molar teeth, but so as to be easily removed, is better than artificial teeth. It may be removed and laid in water while eating.

To mount these specimens in balsam, so that they would not become too transparent, gave much trouble. They could not be stained after the plans of staining tissues or microörganisms, because they failed to hold the stain. But by using preparations soluble in absolute alcohol, and increasing the strength of the solutions, and keeping the specimens in these from twelve to twenty-four hours, and a similar time in clear alcohol to remove excess of stain, fairly good selective stains have been obtained. Thus far eosin—saturated alcoholic solution—and gentian violet, ten per cent. of the saturated alcoholic solution in alcohol, have given the best results. Some specimens that lost their stain in absolute alcohol, stained fairly well after a half hour in formalin four per cent. solution. Not much search for mordants has yet been made. Other stains will probably be developed soon.

These stainings have shown more clearly the forms in which this agglutinating substance is laid down. The globules and other forms mentioned above are shown by this selective staining to be made up of much smaller globules, which show a remarkable tendency to build up round or oblong bodies by agglutinating together. This is shown both by the eosin and the gentian violet, but thus far most clearly by the latter. Perhaps the best idea of these will be expressed by the terms mulberry forms, or lobulated globules.

The gentian violet has developed a remarkable selection among the primary globules. These take the stain differently even in the same lobulated globule, some holding an intense stain, others less, and still others holding only sufficient to make them dimly visible. In some specimens whole fields are almost without stain, while other fields on the same slides are brilliantly stained. These differences are not so pronounced with the eosin stain. The gentian violet stainings indicate variations in chemical construction of the primary globules, or a mingling of two or more globulins. It is certainly giving some very beautiful microscopic specimens.

Another surprising feature of this agglutinin, when considered in comparison with other accumulations in the mouth, is its freedom from microörganisms. The eosin as used stains microörganisms intensely. absolutely black, and this is not removed by absolute alcohol. In this the gentian violet fails. The microörganisms do not hold the color against clear alcohol. Occasionally a glass that has been worn in the mouth for a week or more, waiting for a deposit, will show a good many microörganisms attached directly to the glass, but not mingled with the agglutinin. Other colonies of microörganisms occur infrequently within epithelial cells that have lodged in this material. Otherwise than this microörganisms are not found in it. The oldest specimens, however, have not

been more than twenty-four hours in accumulating, and most of them only from four to twelve hours.

When a very thin section of calculus is made from a piece, the accretion upon which was in active progress at the time of removal from the mouth, the surface portion of the specimen will show prominently the globules that form a characteristic of the deposit of the agglutinating substance. But the precipitate of calcium salts seems to filter into the older part of the deposit and obliterate all appearance of the globular forms.

Grinding Calculus for Microscopic Study.

With my plans of using my grinding machine for grinding microscopic specimens, very fine sections of calculus of any of the varieties can be made by first saturating them with thin shellac in alcohol, drying, and then sticking them to a cover-glass with shellac. Either large pieces or crumbs of serumal calculus may be used. In either case this preparation is dried until hard, placed on the grinding disk and ground to a point chosen for the section. When cleaned and dried, another cover-glass is cemented to the ground surface with more shellac, and this is dried under light pressure at 110° to 120° Fahr. Then the last cover-glass placed is cemented to the grinding disk and the first cover-glass ground away, and the grinding of the specimen completed. The grinding is done in running ice water. The cementing to the grinding disk is done with balsam dissolved in xylol. Xylol does not dissolve shellac, hence the use of shellac. We can dissolve the cover-glasses from the grinding disk with xylol without disturbing the attachment of the specimen to the glass. Then the cover-glass with the section still held by the shellac is inverted and laid upon a small globule of balsam on a glass slide, pressed down, and the mounting is complete. The success of the grinding depends on gaining the right consistence of the shellac. I have sections of calculus from which photographs have been made, which are not more than one-fourth of one-thousandth of an inch thick. In these the individual particles of precipitated calcium salts are clearly seen with a sixth-inch lens.

Deductions from Studies of Calculus.

In the study of this subject I have become impressed with the idea that the conditions of deposit of calculus do not depend upon the presence of more or less calcium salts in the blood, body cells, body juices, or secretions. These may, of course, vary within certain limits without being abnormal. The amount of calcium salts may become abnormally large or small, possibly, in a given se-

cretion, and yet not be a factor of consequence in the deposit of any of the oral calculi. This deposit will depend primarily on the formation and deposit of the agglutinating substance in which the precipitated particles are caught and held. It seems, also, that this agglutinating substance is secreted with the saliva already formed, or formed at once when the saliva leaves the ducts. It is always first found immediately opposite the openings of the ducts, and is usually confined to a small area. In most cases it is not found elsewhere. But in cases in which the secretion of it is very profuse, it will cover over every part of a plate or other solid in the mouth. It has also happened occasionally that I have found this deposit without any admixture of calcium salts, or with very little. When deposited in great profusion the calcium salts usually do not spread far from the openings of the salivary ducts. My present thought is that this agglutinating substance is the product of some fault in the general metabolism going on in the body, and that this in some way ought to be reached and corrected. This can probably be accomplished after sufficient observation.

With this in view, I have been studying the physical condition of persons who have much or only a little of this deposit occurring, and especially those who wear artificial teeth, and whose plates are available for examination and study, counting myself as one of these. In this way I have found persons who have calculus deposited every day, with occasional exceptions only, and others who have a fairly free deposit occasionally for a few days at a time, but for the greater part of the time are entirely free from it. In others still, the deposit fluctuates between none and considerable quantities, in the most whimsical way possible. It is extremely unstable and irregular.

For these purposes the plates should be examined morning and evening—if worn at night—and made perfectly clean after each examination, or three times per day is sometimes desirable. A deposit six to twelve hours old will not wash away in running water—warm or cold—within a few minutes or in half an hour, but is easily broken up and removed with the brush. If it is twenty-four hours old it is not removed so easily; when two days old, its removal becomes difficult. When a week old it cannot be removed with the brush and water. It has become too hard and too firmly adherent. This kind of examination is of great importance in becoming acquainted with the necessary care in keeping the teeth, or any plates worn in the mouth, clean.

Cathartics Prevent Deposits.

In noting the condition of persons, I discovered that when the deposit of calculus was rapid and practically continuous, a saline cathartic would stop the deposit completely within a few hours. Generally

this stoppage continues from one week to three or four weeks. Then the deposit will be gradually resumed.

In my own case I was much troubled with deposits of calculus some years ago—more than at any time in my life before. The cathartic—Epsom salts—would stop it for from seven to ten days. Although not a heavy feeder, I determined to try limiting the amount of food and doing a greater amount of Fletcherizing. I was still careful, however, not to go hungry. I found I could limit my food nearly one-half without the least inconvenience, and felt better for it. This ended the deposit of calculus at once, and now for months together I have been unable to find a trace sufficient for a specimen. But lately I have learned to bring on a deposit almost at will by eating heartily of rich foods.

One case, a paralytic for a number of years, whose husband is a dentist and a friend of mine, is interesting. There are but a few days in the year when there is not a heavy coating of calculus on her plates. A saline cathartic will relieve this for a few days only, when it returns. It is only a question of frequent washing, however, to have bright, clean plates. There is no necessity for anything more than a good brush and plenty of running water, in this or any other case, for artificial teeth or natural teeth, cleaned regularly twice per day. Certainly no one should do less than this, whether there are deposits of calculus or not. And yet, one is very much more comfortable physically and mentally if there are no such deposits.

The above mention of the use of Epsom salts might lead to the idea that constipation is the main cause of the deposit. This seems not to be correct. Persons do not have deposits of calculus because of constipation. It is much more probable that the cause is associated closely with the formation of a larger amount of chyle than can be properly assimilated, and that this leads to errors in metabolism in which the agglutinating substance is formed and deposited from the secretions. The Epsom salts acts by increasing the elimination through another route.

Years ago I had learned to have no dread of the evil effects of salivary calculus upon the gingivæ among the patients under my care, except a few that could not be induced in any way to do the necessary cleaning with regularity. I suppose we will have these careless ones to deal with forever, and that they will suffer the penalties of their carelessness, no matter what we may do for them. Cleaning twice per day is all that is really necessary for health. If the cleaning is done regularly after eating, it gives a greater degree of personal comfort, and for that reason pays a rich interest on the labor investment.

Serumal Calculus.

With deposits of serumal calculus the case is different. These deposits occur in the subgingival spaces which cannot be cleaned with the brush; yet the use of the brush, followed by the rubber bulb syringe, seems to be important in preventing those conditions of irritation of the gingivæ to which such deposits seem to be due. For after long, careful observation, I am of the opinion that the beginning of this deposit is due to an irritation that calls out an increased flow of the otherwise normal secretion that bathes the subgingival spaces in their healthful conditions. Since the actual discovery of the agglutinating substance necessary to the formation of salivary calculus, the thought has come that the same bodily conditions may be active in the deposit of all of the oral calculi. Be this as it may, there are certainly systemic states which occasionally produce such condition of the gingivæ as increase the flow of their secretions temporarily, and seem to determine the beginning of these deposits. When the deposit has once begun, its presence is sufficient to continue the irritation and continue the increase of the deposit. It may be found, however, that like salivary calculus, a certain condition of the system is necessary to produce a special agglutinating substance without which no deposit occurs. In this I am dealing with suppositions, not with facts made clear by definite observations.

That which is definitely known is this. In a mouth known to be habitually healthy we suddenly find deposits of serumal calculus in the subgingival spaces. In a large proportion of these there will be no more of this calculus formed if *all of it* is removed and the subgingival spaces well washed. In some of the cases, however, the deposit will recur time after time, and must be carefully followed by removal of the deposits at frequent intervals, to prevent grave injury. Such deposits may disappear after an indefinite time—one to five years—if carefully followed, and not reappear.

If these deposits are allowed to remain, the gingivæ are absorbed exposing them; new deposits occur in the space gained, and the destruction of the gingivæ proceeds little by little until the condition becomes bad. In other cases a deposit determines the formation of a pus pocket beside the root of one or of several teeth, and the beginning of final destruction of the membranes is under way.

A typical illustration of this, previously mentioned, is presented in those cases in which, because of a deposit of serumal calculus in the lingual subgingival spaces of the upper incisors, pus pockets are formed. Some of these seem to occur without the calculus, *i.e.,* from other causes. In these there is a movement of the incisors to the labial. This is very slow at first, but becomes more rapid. This brings a similar movement

of the bicuspids and often of the molars also, in a seeming effort to fill the space. The occlusion becomes demoralized, the contacts between the teeth are loosened, the septal tissues are injured by impactions of food, more pus pockets are formed, and after years of efforts to cure, the teeth are lost.

The best defense I know against the evil effects of serumal calculus is in the use of the brush and the ordinary rubber bulb syringe by the

Fig. 1.

patient after careful training by the dentist. It may be that a limitation of the diet will succeed. I am of the opinion also that no medicine at all is the best treatment, and especially no antiseptic whatever should be used. Any scales of serumal calculus should be removed with great care as often as these can be found, and the subgingival spaces well washed with normal salt solution after the cleaning—nothing more; then the brushing twice per day at the least, followed by a thorough syringing with plain water. I place great importance on the syringe with a strong stream thrown on the gingivæ from the occlusal, so as to turn them outward and clean the subgingival space, and the drilling of the patient in its use. Absolutely no tooth powders or pastes of any sort should be used.

As to pus pocket calculus, that comes only in what may be termed advanced cases of destruction of the peridental membranes, and consideration is not called for in discussing the beginnings of these affections.

FIGURE 1.

Photomicrograph from a section of a crumb of very black serumal calculus. (See description of process of grinding in text.) The outer surface is the lower border of the picture, upon which accretion was in progress. It gives a slight showing of globules. The irregular veining shows lines of accretion.

NOTE.—This series of illustrations have been photographed from the author's specimens by Dr. F. B. Noyes, of Chicago.

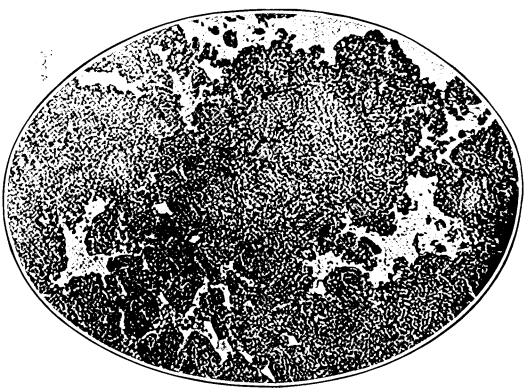


Fig. 2.

FIGURE 2.

Photomicrograph of agglutinin of salivary calculus moderately well filled with calcium salts, but very soft. It was pressed down under a cover-glass in a thick solution of shellac in alcohol, after thirty minutes in alcohol to remove water. The general appearance of globules is fairly well seen.

1½ inch lens, 4½ foot bellows.

FIGURE 3.

A device attached to a plate for artificial teeth, used for the collection of specimens deposited directly on a bit of the usual cover-glass for microscopic objects. It consists of a bit of No. 26 gold plate fastened to the plate with a gold screw at each end. All of the central part is cut

away, as shown. The rubber plate has been cut flat over the area covered by the frame, and above and below ledges are left which will prevent a glass cut to fit the space slipping out in those directions. The screws keep it from slipping out endwise. The cover-glass is laid in the space, the frame is laid upon it, and screwed down. This exposes all of the central part of the cover-glass for the collection of films. When a film has been deposited on the glass while being worn in the mouth, the screws are removed, the frame lifted off, and the cover-glass, with the film un-

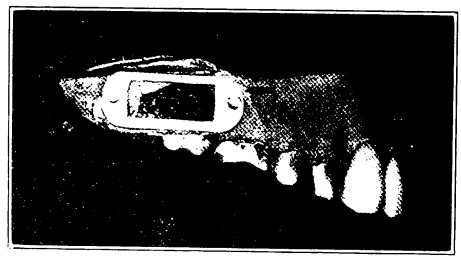


Fig. 3.

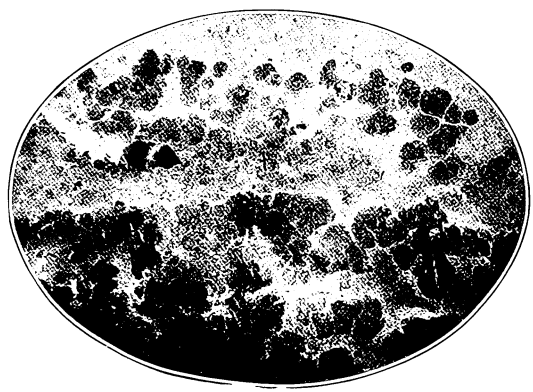


Fig. 4.

disturbed, is lifted and transferred to the liquids prepared for the staining process. A similar device may be attached to the natural teeth in such a way as to be removable.

FIGURES 4, 5, 6.

Agglutinin of salivary calculus showing irregular globular forms laid down on cover-glasses worn in the mouth.

(1½ inch lens; bellows 4½ feet. Eosin stain with formalin as a mordant. The stain is diffuse.)

In this deposit the thickest globules show darkest. The finer globules, of which these are made up, are not distinguishable in the pictures. The tendency to form larger globules by the combination of smaller ones is apparent, but presents the utmost irregularity in the different specimens.

NOTE.—The beginning of the deposit always occurs in the little angle formed by the frame and the cover-glass (see Figure 3), and grows out upon the glass from that beginning. The cover-glass has generally been

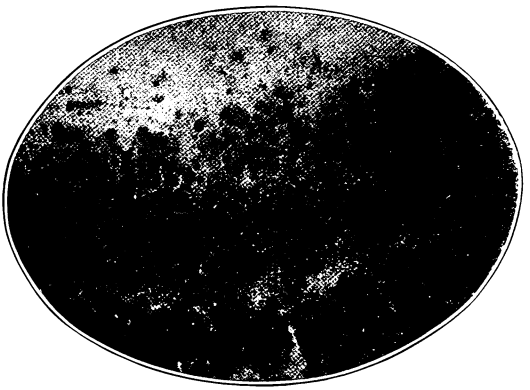


Fig. 5.

Fig. 6.

removed before being completely covered, in order to have thin margins. All the specimens are so placed that that portion next to the frame *is down* in the illustration.

FIGURE 7.

Ground section of hard salivary calculus ½ of $^1/_{1000}$ inch thick, showing globules in the upper part of the field. While these globular forms are hard calculus, that portion has not received as much calcium salts as

it will contain later. The globules finally become almost completely obscured, as seen in the lower portion of the illustration.

1½ inch lens; bellows 4½ feet.

FIGURE 8.

The appearance given by an accumulation rapidly formed (within four hours), stained with gentian violet, after having been coagulated by phenol, 5 per cent. solution in water, and the uncombined phenol carefully dissolved out by repeated washing. The lower right-hand corner of the picture was in a corner of the frame.

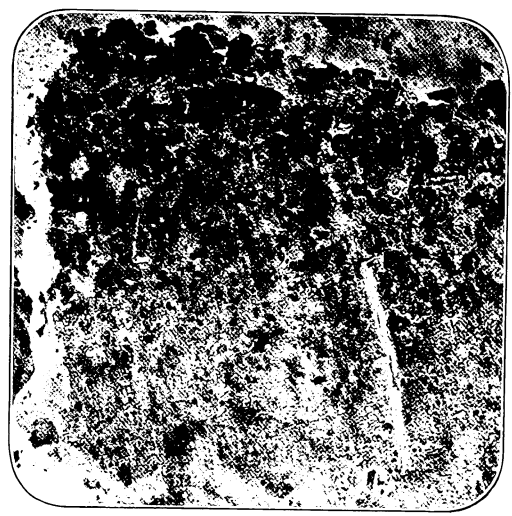


Fig. 7.

1½ inch lens; 4½ foot bellows.

It will be noticed in this that certain of the smaller globules stain more prominently than others, and that the larger globules are agglomerations of the smaller globules. This specimen was perfectly transparent before coagulation with phenol. At certain points the accumulation was too thick for photography.

FIGURE 9.

Appearance given by an accumulation forming in about ten hours, stained by gentian violet after it had been exposed to 4 per cent. formalin for one hour, and repeatedly washed to remove uncombined formalin. It remained in the staining solution twenty-four hours, and was washed in

Fig. 8.

absolute alcohol, which was repeatedly changed, and much of the time kept in motion for about two hours.

1½ inch lens; 4½ foot bellows.

This specimen gives a beautiful appearance when seen in the microscope, but as the stain is a bright blue with gradations of the intensity of color in the different primary globules, it is only imperfectly represented

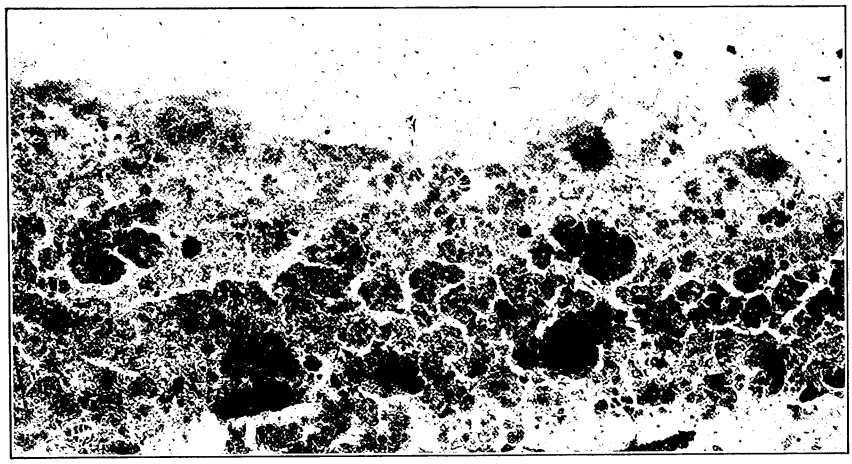


Fig. 9.

by photography. The conglomerate structure can, however, be made out fairly well.

FIGURE 10.

From the same specimen shown in Figure 9, but taken with a $^2/_3$ inch lens with a 4½ foot bellows, and showing only the central portion of the field in Figure 9. In this a multitude of fine globules that take the stain sharply appear in the make-up of the large globules. In some specimens globules are made up of primary globules that take the stain differently, showing distinct chemical differences in these primary globules that join in making up the larger compound forms. Thus far this is well shown only by the gentian violet stain, following formalin as a mordant. Other stains may yet be found that will make these selections and be better for photographing.

FIGURE 11.

A stain by nigrosin following phenol. Certain of the globules do not stain at all; otherwise the stain is diffusive. A number of light-colored

circles will be seen in the upper part of the field, which are unstained globules, with a collection of fine granules about them that take the stain poorly. Many of these white globules appear in the thicker portions

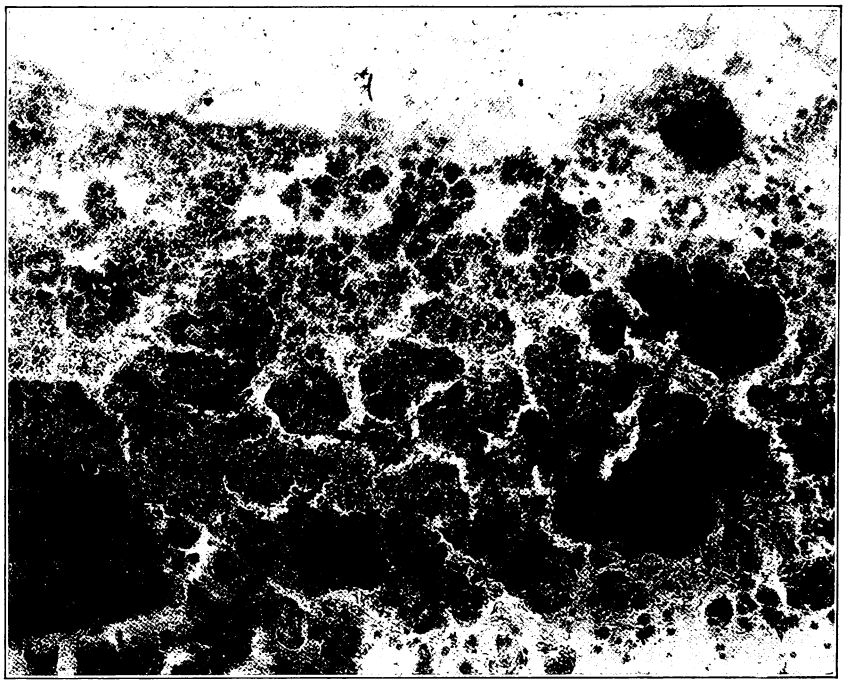


Fig. 10.

partially covered with globules that stain. Therefore their outlines appear irregular. Many of these peep through the thicker portions as white points.

1½ inch lens; 4½ foot bellows.

FIGURE 12.

Appearance of a rapid deposit (about four hours), stained by nigrosin after treatment by formalin as a mordant. So far as the stain goes it is diffusive, but many of the primary globules refuse the stain, which gives a lobulated appearance.

1½ inch lens; 3½ foot bellows.

FIGURE 13.

A slight but very diffuse deposit occurring slowly at the ending of a paroxysm. There is a sprinkling of globules that take the stain sharply,

Fig. 11.

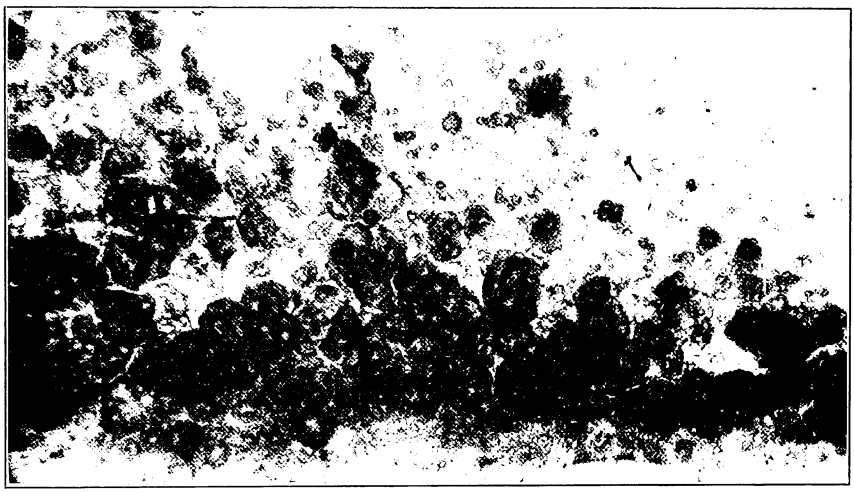


Fig. 12.

among many fine globules that do not, and a considerable number of small circles scattered over the field formed by accumulations around globules which do not take the stain.

1½ inch lens; 3½ foot bellows.

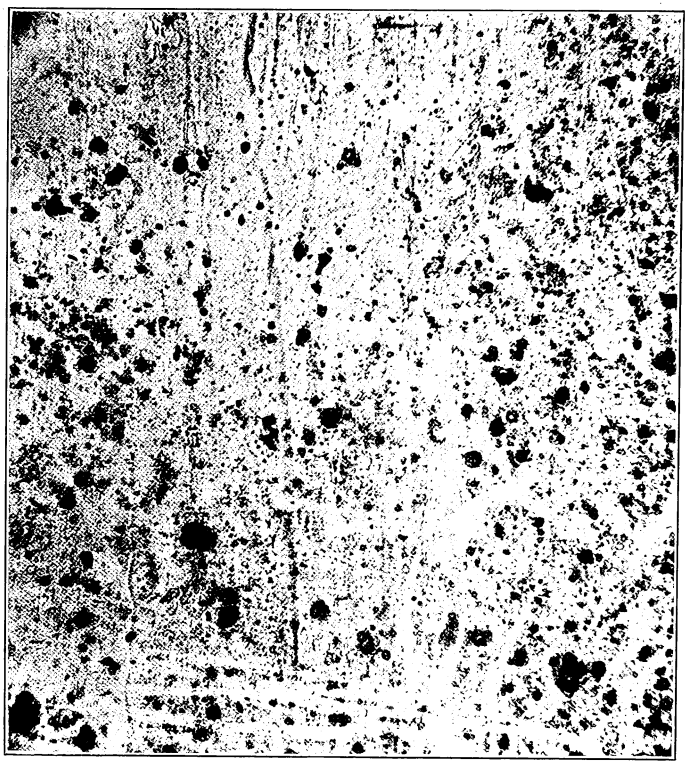


Fig. 13.

FIGURE 14.

This is a deposit of a peculiar type that does not seem to attract calcium salts, but will form a cheese-like accumulation on the teeth or on plates. This, when cleaning is neglected for a few days, becomes too stiff to be removed with a brush, but I find that persons form the habit of scraping it away with the finger nails. I have seen this most in persons whose nutritive powers are very low. It is very persistent in some confirmed paralytics. It has not, however, been sufficiently studied. Nigrosin stain.

1½ inch lens; 3½ foot bellows.

FIGURE 15.

This shows a deposit of finer globules of a type of material similar to that shown in Fig. 14. A few small circles occur in this. Nigrosin stain.

1½ inch lens; 3½ foot bellows.

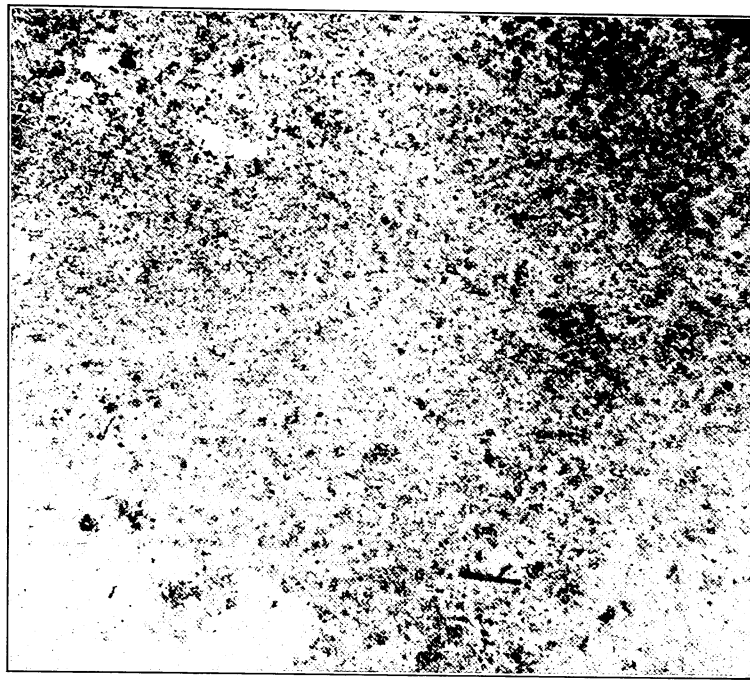


Fig. 15.

Fig. 14.

NOTE.—These illustrations give the best showing of the forms presented by these deposits that I am able to give up to the present time (April 15th). It has now become apparent that there is much variation among these deposits as to the collection of calcium salts that are due to chemical differences. Some of them cause no precipitation of salts, while others cause very rapid precipitation, becoming white, or a yellowish white, within six to ten hours after the deposit of the agglutinin begins.

Though this matter has not yet been sufficiently studied, it seems evident that the deposit of the salts is called out by the presence of the agglutinin, and is not a falling of the calcium salts out of solution because of the loss of carbon dioxid, as taught by Dr. Burchard and others. It seems to be due to a positive chemotaxis existing between the salts in solution and the deposited agglutinin, or globulin, which calls the two substances together in this form.

When freshly deposited, this agglutinin is remarkably free from micro-organisms, but after twenty-four to thirty-six hours, immense numbers are found. Then the deposit melts down rapidly and the calcium salts become hard. These matters, however, have as yet had but very superficial study.

Cleaning Teeth.

The Brush.

Cleaning the teeth has, in our artificial methods of living, become essential to the health of the teeth and the gingivæ. A few persons are found who have teeth and gingivæ of such excellent forms, and who use their teeth so vigorously that the natural cleaning by the excursions of food over them seems fully sufficient for their purposes. Their teeth will be found clean and free from lodgments, no matter when they are examined. In these cases the good, natural forms are probably efficiently aided by a quality of saliva that readily dissolves any food particles that cling to the teeth and do not themselves precipitate any of their colloids.

But this is not true of the large majority of persons. Artificial cleaning is essential for both children and adults. This cleaning should, for the most part, be done with the tooth-brush and syringe. Other aids, such as the toothpick, silk floss, rubber bands, etc., also have their place. It should begin with the child and continue practically through life as one of the essential elements of personal care for health and comfort.

The call for this artificial aid is in large degree due to living on softened foods, the evils of which should be met by art. The tendency among men is to live on softer and softer foods of artificial preparation. This gives less and less cleaning effect in mastication, and this loss must be supplied. In the article of meats, the cold storage plans of preparation have reduced the force required to crush the fiber nearly one-third since I became able to measure it in 1893. Other articles of food are made softer year by year. The only way to meet this tendency is to supply the lack of *natural* cleaning formerly done by the mastication of the harder and coarser foods, by *artificial* cleaning.

It is especially the duty of the dentist to superintend this cleaning and prescribe what should be done, and how it should be done. He should teach patients in his chair, the parents, the nurse, and especially the child, to look after this. He should teach them the best ways of handling the tooth-brush. The so-called up and down motions, or more definitely expressed, the occluso-gingival and gingivo-occlusal motions, which are parallel with the length of the crowns of the teeth, are the most important and least known. These should be used much more than the back and forth movements across the crowns of the teeth. In making these motions up and down, much the greater stress should be placed on the motion toward the occlusal surfaces of the teeth in both the upper and the lower jaw. These motions should generally be made separately for the upper and the lower teeth with the mouth slightly open, so that the bristles of the brush will enter the embrasures to the full depth, to remove, so far as may be possible, any food particles retained there. Gen-

erally the brush will catch and drag away any stringy foods lodged between the teeth. Where this fails the tooth-pick and the syringe should be used as a supplement to the brush.

When the gums are much swollen, or are redundant, as they are frequently found in childhood and in early youth, the brush will be ineffective in cleaning, both the embrasures and about the contact points, because of the fullness of the gingivæ, which prevents the bristles from entering these spaces. It is especially in these cases that the toothpick and the syringe are needed to complete the cleaning.

When the motions described above are learned by the adult or by the child, they are made easily, and may be made very rapidly. They should usually be supplemented by the back and forth motions. When these motions have been learned by the child, or by the adult, the dentist should make frequent examinations of the mouth to see whether, in the formation of habits in this work, some parts of the mouth or teeth escape the motions of the brush and receive no cleaning whatever, or insufficient cleaning. I have sometimes found this very exasperating. Children, sometimes adults, too, who seem to have the intent to do this work very well, and with regularity, persist in missing some important portion of it. This tendency should be corrected time and again until fully correct habits have been formed, or until every part of the mouth is regularly and efficiently cleaned.

This cleaning should not consume much time. Scrubbing away at the teeth vigorously for fifteen or twenty minutes each time the brush is used is both foolish and harmful. A regular order of movement of the brush that will bring it to bear on all parts to be cleaned, should be adopted and worked into a regular habit. A few strokes upon each part should be made and the brush laid aside. In any case in which there are open interproximal spaces the syringe should be used after the brushing. Two or three minutes should be sufficient time to complete the cleaning in any case.

Syringe.

The best syringe available at present for assisting in cleaning the teeth is the ordinary rubber bulb syringe used by dentists for water or for air. The cases in which these are most especially useful in the hands of the patients are those in which some of the interproximal spaces have lost the whole, or a part, of their septal tissues. Such spaces cannot be satisfactorily cleaned with the brush. But if the accumulations are first broken up with well-made wood toothpicks, a strong stream of water from the syringe cleans such spaces very well. Persons with many open interproximal spaces soon learn to run the nozzle of the syringe around the arch, throwing a strong jet of water through each, and do this cleaning

very quickly. Persons who have deposits of serumal calculus may be taught to throw a stream of water in such a way as to turn the free margins away from the teeth and clean the subgingival spaces efficiently.

The time for this cleaning should be immediately after each meal of the day, or at the very least after the morning and evening meals. Some persons should add a fourth cleaning for the day before retiring at night. This plan of work is suitable for both children and adults. A few adults will need a brush with a short crook in the handle, to enable them to reach the lingual surfaces of the lower incisors in case these teeth have a strong lingual inclination. As a general rule the ordinary straight tooth-brush will do the best service. The brush should not be too closely filled with bristles; for in this case it is too hard and stiff for the bristles to go into the embrasures and about the contact points well. If the bristles are moderately stiff, or a large portion of them are clipped at their free ends, the brush will do better work. I usually recommend that children and young people have a fifteen to twenty-five-cent brush.

Children should be taught to use the brush with their own hands at a very early age. Just how early should depend much on the aptness of the child. Above all, they should be taught regular habits in the use of the brush. Occasional cleanings fail entirely in their object. To be of real value, the cleanings should follow the meals regularly, and be so effective as to prevent decomposition of food particles in the mouth, and especially between and about the teeth.

It is my belief that if dentists generally would study this matter carefully, and join heartily in teaching their patients plans of cleaning teeth, and drill them into efficiency, it would benefit the health and usefulness of our people more than all of the physicians of our country can do. This work should be made efficient, and yet should be made to consume but little time. Two to four minutes is abundant time to do it well, if done regularly after each meal. All tooth powders, tooth washes and the like should be banished completely, and a few minutes' friction with clean water alone used, following the regular meals of the day, and every day.

Antiseptics.

The studies of bacteria and bacterial diseases, the means employed in treatment, etc., should be divided into three historical periods:

First period.—From Lister, 1869, to Koch, 1880, in which the studies were made mostly after the plans of Pasteur, and were difficult in the extreme.

Second period.—From Koch, 1880, to Metchnikoff, 1893. Under the plans discovered by Dr. Koch of analin staining and of cultivating on semi-solids, including the plating process for the separation of species, the study of separate diseases and their bacterial poisons was made easier, more certain, and rapid accumulation of the facts in these lines resulted.

Third period.—From Metchnikoff to the present. The study of the rôle of leukocytes and of defensive bodies in the mechanism of immunity to bacterial diseases, the repair of wounds, repair of injuries by suppuration, and the general defenses of the animal body against the inroads of bacteria.

In the year 1869 Mr. Lister, a surgeon of Scotland, after following carefully the debates which had been going on between Pasteur, affirming, and Baron Liebig, denying, that the decompositions known as fermentations and putrefactions were caused by microörganisms, determined to try the effect of the exclusion of microörganisms from operative wounds. Mr. Lister seems have had no fixed idea of what the result would be. But as most of the evils following operations were at that time charged to the decomposition of the wound secretions, he reasoned that prevention of this might be possible. For this trial he made preparations for thoroughness that now seems to border on the ludicrous. He made his operations successfully, and if we may rely upon his expressions afterward, was much surprised to find that operative wounds so done healed without a drop of pus.

This announcement by Mr. Lister set the medical world ablaze. Quickly denials and affirmations were flying fast in all quarters. But as more and more of the strong men made the trials following Mr. Lister's plans of excluding microörganisms, or modifications of them, began to add numbers to these affirmative statements, the excitement knew no bounds. Within a few short months the study of bacteriology, which before had been relegated to the ultra-scientist, who was supposed to have little else to do, became a medical study of the liveliest character. I remember that I did not wait to find a culture oven in the market, but built one at once. As I did, hundreds of other men did all over the world. A great class of nondescript things they were, but they did the work and pointed the way to the adaptation of more perfect types of apparatus.

That which was unbelievable at first became a settled fact in the minds of many enthusiasts, and quickly won the approval of the most careful men. Rapidly the idea that all communicable diseases were produced by microörganisms took shape, and the most determined search was made to learn by actual test whether these sayings were true. Many of these affirmations were quickly confirmed by what at that time seemed accurate observations. True, much work went wild, but in the tumult

much truth was developed that has stood the test of time. The subject had become a medical subject in fact, and to stay; and with the years has developed into a science of the most beneficent quality.

The first ten years of this work was done under the utmost difficulties. The improvement in the plans of the cultivation, separation, and identification of species of microörganisms, was slow and extremely difficult during the use of the plans developed by Pasteur. But in the early 'eighties the general utilization of the discoveries of analin straining and the methods of cultivation upon solid and semi-solid media—gelatin, agar-agar, condensed serum, etc., and the plating processes developed by Dr. Koch, made the separation and identification of species and varieties of microörganisms so much easier and so much more definite, that certainty took the place of uncertainty, and the development of our knowledge of microbic diseases went forward at a rapid rate.

Before these discoveries, medical men were using a variety of chemical substances for the prevention of decomposition in liquids and semi-solid substances. By direct experiment many of these were found to be germicides. They killed the microörganisms which produced the decompositions. They killed those microörganisms that experiment had shown to be pathogenic. The use of these to combat pathogenic organisms at once began with the greatest confidence that the discovery of the cause of the disease had opened the way to its cure with drugs already at hand.

When Dr. Koch found the organism responsible for tuberculosis, he turned to these drugs with the fondest hope that he had also found a cure. But the trial was a sore disappointment. He could readily destroy the germs of tuberculosis in the cages of the animals he collected for experimental purposes, and prevent them from contracting the disease, but those that had already contracted the disease he could not cure.

When Miller found the microörganisms of dental caries he also turned to the germicides in the effort to eradicate the disease; and when, after years of trial, he was forced, by the stern facts developed, to admit that he could not sterilize his own mouth, this fond hope that with his discovery of the cause of the disease, he had also discovered a cure, was dashed to earth. All the facts would allow him to hope for was that great care as to cleanliness would limit the disease materially. He had not even the assurance which Koch had as to the prevention of tuberculosis by preventing contagion, when he could have the command of the conditions. Even this was denied Dr. Miller, because every human mouth was found to be infected, and this infection could not be eradicated. These and similar cases were sore disappointments to the experimenters and to medical men who were led to the expectation of great results.

I have lived through all of these periods. I have been actively interested in every movement and every announcement of importance that was in the English, German and French languages. I have been through the whole range of the trials of antiseptics in croup, diphtheria, scarlet-fever, measles, typhoid fever, tuberculosis, etc., and the abandonment of the effort. Again we were able to prevent the spread of disease to others by the disinfection of apartments, clothing, the excreta of the sick, etc., but we could not materially shorten the time of the illness or modify its severity. The great triumphs of bacteriology in this period was in sanitation rather than the cure of the sick.

Theory of the Usefulness of Antiseptics.

The most persistent use of antiseptics has been in the endeavor to combat suppuration. If pus is caused by microörganisms, and only by them, and if germicides destroy microörganisms, certainly these drugs should be applied, as antiseptics, in the cleaning of accident wounds, and to suppurating wounds, abscesses, etc. This has been the constant thought of medical men ever since Mr. Lister announced the success of his first experiments, until lately many surgeons are discarding them; and we dentists have used antiseptics even more persistently than the surgeons, and have used them in solutions of a strength that surgeons do not often employ. I have been, perhaps, as enthusiastic in the use of antiseptics as others. It was first with Beechwood creosote, and later with 95 per cent. carbolic acid pumped through the apical foramen until it appeared at the opening of the sinus, that I made my first successes in the treatment of chronic alveolar abscess, away back in the fifth decade of the past century. I continued the use of such remedies for many years, but it is not a matter of which I have written much, though the study of them has been constant. The most notable article that I have published on this subject was printed in the *Dental Review* in 1889, just about twenty-two years ago. I turned back and read it as I was writing this paper, and found in it warnings of injury to the tissues by the too free use of antiseptics. These warnings seem to have been unobserved by dentists. The free use of the germicides as antiseptics has continued, and, if possible, has become more pronounced.

History of a Case Treated with Antiseptics.

But I had stronger reasons for these warnings than were given in that paper. As a case in point, I will relate this: Two boys, thirteen or fourteen years old, were afield with their guns; as I remember it, their first independent hunt. One of them put his gun through a fence, and in the attempt to climb over, a rail broke and he fell. Somehow the gun went off, and the load of shot, at short range, struck his right arm one and one-half inches above the wrist joint,

angled through, coming out about the same distance from the elbow joint, tearing out all of that part of the ulna and the soft tissues. Many shot, as I found upon examination, had also been deflected into the elbow joint. This happened three or four miles out of town. I saw the boy as soon as he was brought in. A surgeon was summoned also. The patient was my nephew. Shock was not considerable. The radial artery was uninjured, and the hand would live if that terrific wound could be managed. Sensation was lost in the little finger and the distal half of the ring finger. As I was going over these points carefully, I found that the surgeon had come in quietly and was looking over my shoulder. He said: "Shall we cut off the arm?" I said, "No," with some hesitation, and was at once asked if I had made out a line of treatment. "Yes. But if suppuration should occur the arm must be removed immediately."

Just prior to that time some remarkable successes in treating severe wounds by the continuous bath had been reported. We had been making trial of it in experimental operations, and a trial of it in this case was determined upon. The necessary apparatus was quickly constructed, and the arm was laid in a pan of water, and the water was kept constantly at the temperature of the body, and also in continuous motion by special devices. For a short time five per cent. of carbolic acid was added to the water, then the proportion was dropped to one per cent.

With this arrangement the boy was comfortable. Within a few days he was seeing his friends, reading some, and suffering little inconvenience except that which comes from confinement in bed with very limited opportunity for movement. As week after week passed, there was no sign of suppuration, nor was there any sign of healing. Not a single point of growth of granulations was discovered. This continued for six weeks.

Then the arm was removed from the bath and an aseptic dressing applied. With the proper precautions this was opened occasionally for inspection. It was about three weeks more before the first trace of granulation was discovered. Then tissue growth began very slowly and in a weak way. The boy was well enough, took food well, slept well; he was in good physical condition. Very gradually the granulations became stronger, the wound healed very slowly, and made a good recovery without pus. This slowness was due entirely to the excessive use of the solution of one per cent. of carbolic acid. That wound ought to have healed within three weeks instead of sixteen. This is the legitimate effect of carbolic acid. In varying degree it is the effect of every germicide when used persistently as an antiseptic. Germicides not only slow down the growth of microörganisms, but they slow down the normal action of the tissues as well.

This young man went on with his school work after recovery, grad-

uated from Yale, and has become an important man in his community. The hand, however, is not of much use; there was too much loss of muscular tissue. The elbow joint was too much injured to expect movement, and from the first the hand was laid in the best position for use with a stiff elbow. Of course, no rotation of the forearm was expected.

History of a Treatment Without Antiseptics.

Contrast this case with another that occurred twenty years afterward. A neighbor woman came hastily into my office with a lacerated and bleeding hand. She had attempted to chastise her pet dog for some misdemeanor, and the brute seized her hand and literally tore the large muscle of the thumb on its palmar side—the pollices—into shreds, and tore the skin so badly as to almost completely uncover the muscles. Indeed in the condition as I first saw it, the hand looked as if ruined. After a careful examination I washed the whole hand and forearm to near the elbow with warm water and soap; indeed, gave the skin a very thorough scrubbing, for I intended to include all of this in a final protective bandage. Next, a small nozzle with an opening about one millimeter in diameter, connected with a supply of normal salt solution, was turned into the wound. With this nozzle every part of the injured tissue was traced out over and over again until two gallons of the solution had been run through the shreds of tissue in the effort at thorough cleaning. Then the injured tissues were brought into the best relation that seemed possible, and secured. It was then covered with a layer of sterile bandage, over that a thick layer of sterile cotton to absorb a probable flow of serum, and over this a final bandage, which included the whole hand and forearm. The patient was instructed to be quiet in bed for two days, and told that the bandages were not to be disturbed for two weeks, unless the secretions wet them through—unless there was pain—unless there were fever and soreness of the lymphatics in the axilla. None of these danger signals appeared. Two weeks later the bandages were removed. The wound had healed completely. The muscles were too short and had lost in size. Much of this was recovered after some months of use, so that really the hand was almost normal again.

In this the quick action of the tissues was due to placing them in the best possible condition as to cleanliness, and allowing nature undisturbed opportunity to repair the damage in her own way.

Both of these cases had what I should class as careful treatment, with full command of the cases. Both might be regarded as fortunate in their results—both were probably infected cases, and especially the second one. The results place simple painstaking cleanliness in contrast with similarly careful cleanliness secured by the continuous use of antiseptics, and the difference in the two cases was in the action of the tissues in the reparative process.

Phagocytosis.

While these things were being repeated over and over again in the practical phases, another phase of this subject was being studied out little by little by the wise men in the laboratories. This may be said to have begun with the discovery of phagocytosis by Metchnikoff in 1893, only eighteen years ago. Before 1893 the energies of laboratory men had been directed to the study of individual toxins produced by pathogenic bacteria.

Metchnikoff's discovery of phagocytosis in 1893 seems to have guided the laboratory men to the study of the means used by the vital forces of the animal body to combat the injuries by bacterial poisons, of the development of immunity to such poisons, and the mechanism of tissue repair. The discovery of a whole line of these forces brought to bear against bacterial invasion and the injuries by toxins has resulted, most of them in very recent time—indeed within the last decade. These include the development of a knowledge of the antitoxins that antidote the toxins and bring about that immunity to a recurrence of the particular disease in the individual after one attack, as in smallpox, yellow fever, typhoid fever, almost the whole line of infantile diseases, etc., and accounts substantially for the self limiting character of all of these affections, and the mechanism of the immunity which follows. These now constitute a known line of defensive bodies created by the tissues under bacterial irritation for their own use against these intruders. In addition to phagocytosis and the antitoxins proper, we may now count opsonins, which prepare bacteria for destruction by the leukocytes; the lysins which dissolve the bacteria, and the agglutinins, which are active defensive agents in typhoid fever, in the growth of many pathogenic organisms, including some of the more virulent pus-forming organisms, particularly the much dreaded pyogenic streptococcus longus.

For the confirmation of these statements I must refer to Williams's "Manual of Bacteriology," or other manuals of like character, most of which have in their later editions condensed reviews of these bodies, with abundant citations of the original sources of information in their articles on bacterial poisons, defensive bodies and on immunity. The further following of it here would make this paper much too long. Of this investigation Williams in his 1908 edition, page 198, has this remarkable paragraph with reference to these discoveries:

"Studies of immunity have led to remarkably uniform results in so far as the facts are concerned, and there is great unanimity in regard to the actual observations, both of the processes which take place spontaneously in nature, as well as those that follow intentional experiments. There is, however, great difference of opinion upon the interpretation of these phenomena, and several opposing theories have been advanced in

regard to the mechanism concerned, each theory finding eminent supporters."

Antitoxins.

The use of antitoxins—the serum of the blood of an animal especially immunized against the particular disease—in the treatment of diphtheria, of rabies, and of tetanus, seems to have come to stay. They are triumphs over the most dreaded diseases known to man. The results of the immunization with serum in these diseases are great triumphs of present-day laboratory study. The present indications are that more such results will follow speedily.

Treatment of Pus Cases.

Turning now specifically to the treatment of pus formation, all of the observations show that these tend to spontaneous cure by passing through certain stages, unless there is some specific hindrance. The common boil arising as an inflammatory process produced by bacterial invasion, passes to the stage of suppuration, discharge of the secretions, followed by the healing of the injury. So general is this course followed that it is confidently expected by every trained observer. But if there is necrosed bone in which microörganisms may find protection from the direct action of the tissues, and may grow and continually reinfect the region, pus formation becomes chronic and continues. The pulp chamber and root canals of the tooth furnish a similar harbor and keep up the reinfection in alveolar abscess, causing it to become chronic. It is more rarely found that the tissues of the region have in themselves lost the power of protective action, giving rise to a continuation of the suppurative condition in chronic form. Otherwise than in these definite forms of interference, we find that the local tissues by a specific action normal to them, and in their own way, drive out the intruding microörganisms within about a certain time. They then resume the normal conditions. It is this normality of tissue action that we must learn to conserve and stimulate in all of our treatments of suppurative conditions.

The studies that have been made show that carbolic acid in one-half of one per cent. paralyzes the phagocytic action of the leukocytes and practically stops for the time all reparatory action of the tissues. (See Williams's "Manual of Bacteriology," 1908 ed., pages 214, 215.) No wonder that there were no granulations in the wounded arm in the continuous bath of one per cent. of this drug, as related above. The examination of the action of other germicides, when used as antiseptics in suppurative conditions, or to prevent infections, show in varying degrees the same paralyzing and retarding influence. Over and over again, and especially in diseases of the peridental membranes, the tissues are dosed with germicides used as antiseptics until their power of recuperation has

been rendered nil, and a condition induced locally from which the tissues will recover tone and active energy only after a long period of kindly treatment.

Furthermore, this condition has been brought about in the mouth, a region of great difficulty from the bacteriological standpoint; a region from which bacteria cannot be eradicated; a region in which sterility cannot be obtained or maintained by any known process; a region in which the tissues, habitually exposed to the presence of microörganisms, have acquired to an unusual degree the normal means of defense; a region in which, of all places in the human body, the normal defensive power of the tissues should be protected and maintained in the normal condition as completely as practicable, using no drugs that tend to lower this power. It is even better to discard drugs entirely and depend directly upon extreme cleanliness, stopping short of injury, as the most efficient aid.

At this point in my writing I received a note from a surgeon reporting that a paper had just been read by Dr. Seelig, of St. Louis, before the Western Surgical Association on "Antiseptic Action by Osmosis," under which title he discussed particularly the penetration of antiseptic drugs into the tissues. His conclusion seems to have been that alcohol and iodine, especially when the iodine is dissolved in the alcohol, penetrate the tissue in greatest degree. But he also showed that any quantity of antiseptic, which was sufficient to act upon bacteria, was also sufficient to act on the vitality of the tissue cells. His experiment showed that an X quantity of bacteria in a clean wound will not produce suppuration; but if the same wound is disinfected with iodine and the same quantity of bacteria introduced, it will suppurate.

These experiments add another proposition to those I have been discussing, and afford an additional reason for limiting the use of antiseptics in dentistry.

For some time I have been endeavoring to learn the attitude of surgeons toward the use of germicides as antiseptics. Reports are much at variance. Some considerable groups of surgeons have abandoned their use; others are moderating their use. But the discussions at the recent meeting show that quite a large number are still using them in their practice. I am of the opinion, however, that the line of studies that I have mentioned, as their purport becomes more diffused and better understood, will limit their use more and more in the future. Tissue stimulants will be sought instead, and especially the stimulation that comes with extreme care to maintain cleanliness. It is especially unwise to use such drugs in regions that cannot be protected from reinfection—as in the mouth—or in cases in which protection from reinfection is very uncertain.

EDITORIAL

Prof. Black's Views on the Beginnings of Pyorrhea Alveolaris.

In this issue we have great pleasure in publishing the latest important paper by Prof. G. V. Black, the main parts of which were read at the annual meeting of the Second District Dental Society in January of this year. On account of the length of this paper, or rather series of papers, Prof. Black kindly suggested that we might publish it in several issues, but, in view of the interest which is sure to be aroused, it has seemed best to present the series complete in one issue, even though this compels the omission of other matter.

Before discussing a few of the features of this essay, we desire to call attention to the title used by Prof. Black. Let not the reader make the error of supposing that Prof. Black is discussing pyorrhea alveolaris in its well advanced or chronic state. At this time he has confined himself to the several accidents, injuries, or other causes which contribute towards the initiation of this lesion.

Implantation and Replantation.

One of the favorite resources of certain present-day specialists in the treatment of pyorrhea alveolaris, men who boast of saving all teeth however loosened, is replantation. These men treat and save as many teeth as possible; then they extract those that do not respond favorably, deepen the sockets and replant the teeth.

The writer recalls one such case where the operator proudly exhibited a "cured" case in which two or more of the lower incisors had been replanted, the alveolar absorption having been so great that not more than one-quarter of an inch of each root entered the socket. The bone had healed around these, and the teeth seemed firm enough—for the time—that is to say there would probably be time enough for collecting the fee before these teeth would become loosened by resorption. Let those who believe in replantation, as a means of saving teeth loosened by pyorrhea, read carefully what Prof. Black has to say. The writer heartily agrees with his deduction that, "The planting of a sterile stranger tooth in a clean, surgically made socket, gives a far better opportunity for attachment than can be had in pus pockets by any treatment known to us."

There is none but a sentimental reason for replanting the patient's own tooth, except, of course, that the tooth is in hand. Having extracted a tooth because of the ravages of pyorrhea alveolaris, would any conscientious operator implant that tooth in another person's mouth? Would he not preferably select a tooth which had not come from a pus pocket? Then why use such a tooth for the patient under treatment?

Prof. Black also warns those practicing implantation against the use of antiseptics in the surgically made socket, and also advises that all antiseptics used for sterilizing the root to be implanted should be dissolved out before introducing the root. Of this he has more of a similar nature to say when treating of antiseptics.

Injuries Caused by Ligatures.

When discussing injuries to the septal tissue and gingivæ, Prof. Black utters an impressive warning against the injudicious use of ligatures when placing the rubber dam. It is the habit of thousands of dentists to tie the dam in place, this tying being done with waxed floss silk, which is tightly knotted about the neck of every tooth isolated with the dam. The ligature is not needed perhaps in more than two per cent. of all cases treated, and these mainly in very short teeth having conically shaped crowns over which it may be difficult to retain the dam otherwise. In the majority of cases the only good purpose achieved by the ligature is to evert the edges of the hole in the dam. This can commonly be done with a smooth flat burnisher, which will not injure the soft tissues. Or occasionally the ligature may be used

passed around the lingual and approximal sides, and the burnisher then pressed against the ligature till the edge of the dam is everted, when it will slip under the free margin and hug the neck of the tooth, whereupon the ligature may be removed. Before applying the dam, either with or without ligatures, but especially where ligatures must be used, the teeth should be thoroughly cleaned and all infectious matter washed away with a powerful spray. This will minimize the danger of infecting the septal tissue.

Calculus.

Dealing with the subject of calculus, Prof. Black presents us with the latest thought on this important subject. His method of collecting material for examination is remarkably ingenious, furnishing as it does an opportunity to obtain specimens in every stage of deposition. An important fact, which the writer believes is a discovery by Prof. Black, is that before calculus can find lodgment upon the teeth, "a colloid precipitate, inspissate or agglutinating substance must first be formed and deposited upon the teeth, or other solid substance, etc." He states that the precipitated particles of calcium salts find lodgment in this material.

This contribution to the knowledge of the accumulation of calculus is of tremendous importance, since it must furnish the first step towards a method of prevention. Consequently, it would seem that a new word should be added to dental nomenclature. Unless Prof. Black himself, or some other scientist, can find a better term, may we not hereafter speak of "Black's agglutinin"* when describing this first essential stage in the formation of tartar?

All operators, of course, recognize the need of keeping teeth free of tartar. Prof. Black announces that the deposition of "agglutinin" is a prerequisite to the lodgment of tartar upon the teeth. Therefore, if the deposition of "agglutinin" can be prevented, the teeth will be free of tartar. Prof. Black says:

"My present thought is that this agglutinating substance is the product of some fault in the general metabolism going on in the body, and that this ought in some way to be reached and corrected. This can probably be accomplished after sufficient observation by numbers of persons."

*This word has been used heretofore in connection with bacteria, but Prof. Black considers that the agglutinin of calculus is properly an agglutinin, though not the agglutinin discussed in bacteriology.—Ed.

Thus Prof. Black sets up a sign-post which points to the path which will lead towards a method of preventing the accumulations of calculus within the oral cavity. Prof. Black himself has already discovered that under specified conditions a saline cathartic—such as Epsom salts—will stop the deposit. In his own mouth he can control the deposit, bringing it on, or stopping it at will.

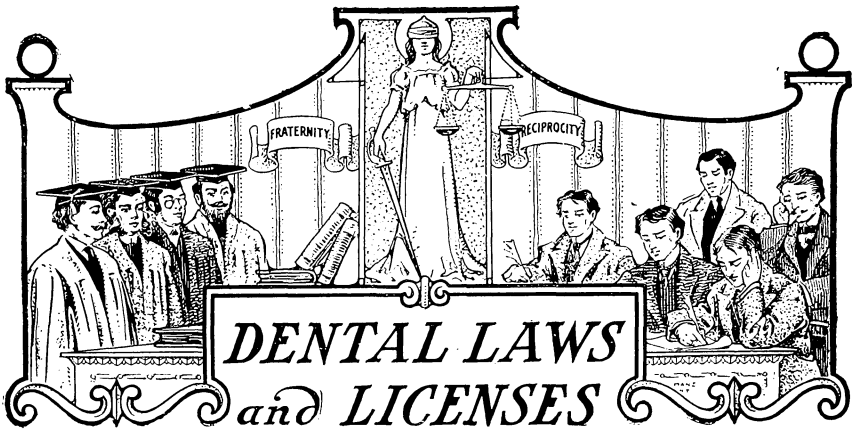
To those who assert that all forms of pyorrhea are purely local in their origin, it may not be inadvertent to point out that speaking both of salivary and of serumal calculus, Prof. Black declares that accumulations are dependent upon constitutional conditions.

Speaking of local treatment against calculus, it will surprise many where Prof. Black says that, "No medicine at all is the best treatment, and especially no antiseptic whatever should be used." "Absolutely no tooth powders or pastes of any sort should be used."

These last two statements will come as a great shock to those specialists in pyorrhea who are carefully training their patients in the use of medicated tooth pastes, as a home treatment for pyorrhea. There are several such "pyorrhea cures" (?) on the market, and the specialists excuse themselves for recommending these nostrums by saying that the formulæ have been privately communicated to them.

But now we learn that either the makers of these pyorrhea curing tooth pastes are mistaken as to the virtues of their wares, or else Prof. G. V. Black is in error. Let the profession decide.

In conclusion, we earnestly recommend all our readers to carefully peruse what Prof. Black has to say on the subject of the cleaning of the teeth, and even more particularly his warnings against the injudicious use of antiseptics on the oral cavity.



Foreign Dental Laws.

By Alphonso Irwin, D.D.S.

We present herewith five countries which require a medical training in order to secure a *license* to practice dentistry. It behooves each dentist of the States to consider well whether he wants any regulations of the following kind, under medical supervision, governing the practice of dentistry. During April, 1911, we received the license requirements and laws from the Argentine Republic, France, and the Balkan States, including Bulgaria, Roumania and Servia. These enactments contain the *legal* features deemed most desirable in each country at the present time, to correspond with the advanced ideas in the profession and the *needs* of the *public*.

Argentine Republic.

The most noticeable characteristics of the Argentine Republic requirements are that:

1. Physicians, pharmacists, dentists and midwives are included together, under the same laws.

2. (*a*) United States diplomas must be legalized by the Department of State at Washington, D. C.

(*b*) The legalization of the signatures and seal should be on the diploma itself, or attached to same by a ribbon under seal.

(*c*) Diplomas must be viséed by the Argentine Minister or the Argentine Consul for the State where the diploma is issued.

(*d*) The diploma must be translated into the Spanish language by a public translator of the Argentine Republic.

(*e*) The diploma must be legalized by the Argentine Minister of Public Instruction and the Minister of Foreign Affairs.

(*f*) The diploma should be presented to the Matriculation Board of the University Faculty, who give the applicant the necessary information as to all the preliminary steps for entering upon the course of studies.

(*g*) The curriculum for the revalidation of a diploma is the same as for students of the University. The fee for revalidation is 350 c/l, or $148.61 in United States currency.

A. The examinations must be progressive, *i. e.*, the full course from the lower to the higher studies.

B. In case of failure of the applicant to pass he can apply later for a re-examination.

C. The time for the examinations are the months of March, July and December.

Five Years' Course Required to Obtain Degree.

France. 1. The most salient features of the latest French dental enactments are the *raising* of the *standards* of the *requirements*.

2. The American dentist who desires to locate in France will find the requirements of the new law which go into effect in November, 1911, much more difficult than formerly.

3. REQUIREMENTS OF THE NEW LAW:

"The course of study leading to the degree of dental surgeon in France now requires five years, divided into two periods, the 'stage' (two years of probationary work in a dentist's office or a laboratory of a dental college), and three years of actual attendance at a recognized dental college. The applicant must produce for his initial enrollment evidence of having completed at least a common school course. The conditions of admitting women are somewhat more strict.

4. "At the end of the second year of the 'stage' the student must submit to an examination of validation, which comprises: first, the execution of a design reproducing the scheme of the exterior form and structure of one or several teeth; second, a practical test in modeling (reproducing several teeth in wax, plaster, wood or ivory) of the mouth; third, making an artificial denture (the execution of a device including metallic part stamped and soldered); fourth, questions on physics, chemistry, mechanics and metallurgy as applied to the dental art; an oral test of half an hour is also given.

5. "The second period of the course, known as the 'scolarité,' requires three years, and includes in brief the following branches: First year, elements of anatomy, physiology and bacteriology; asepsis and antisepsis; complete anatomy of the teeth; their development and articula-

tion with the maxillaries; also operative and mechanical dentistry. Second year, elements of medical dentistry; ausculation of the heart; odontology and hygiene of the mouth. The work of the second year is completed with practical exercises in dental clinics and laboratory work. Third year, dental clinics, dental operations and mechanical dentistry, as well as practical work in different phases of dental art."

EXAMINATIONS:

"A candidate for the degree of dental surgeon must successfully pass three examinations, one at the end of each school year, covering the work done during that period. The French diploma of dental surgeon is issued by the Faculty of *Medicine* of Paris, Lyon, Bordeaux and Nancy. Proper credit in the examination is given for work done in hospitals under the supervision of the faculty. Graduate dentists from foreign countries desiring to practice in France are *required* to pass *examinations* prescribed in the *decree*. They may obtain a total release from the 'stage' and a partial release from the 'scolarité' course upon the recommendation of the Consulting Board of Public Instruction, which bases its decisions largely upon the candidates."

CREDENTIALS AND SCHOLASTIC ATTAINMENTS:

"Dental surgeons are obliged to register at the prefecture, and at the record office of the civil tribunal of their arrondissement, within a month after their establishment in business.

6. "Infractions of the dental laws are subject to criminal prosecutions. The illegal practice of dentistry is punishable by a fine of 1,000 to 2,000 francs (a franc equals 19.3 U. S. cents) and 3,000 francs for the second offense, together with an imprisonment of six months to one year. Failure to register one's diploma is punishable by a fine of 25 to 100 francs. The court may also deprive an offender, temporarily or permanently, of the right to practice his profession. This applies to foreigners as well."

7. FOREIGN DENTISTS:

"Foreign dental students and those desiring to practice dentistry in France are subjected to the same requirements as native students and practitioners; furthermore, unless they are competent (well-versed) in the language of this country they are placed at a great disadvantage in taking the entrance examinations and pursuing the course prescribed, as all examinations are given and all questions must be answered in French. Hence, knowledge of French seems absolutely essential to obtain a dental diploma. State diplomas, authorizing the holder to practice anywhere in France or its colonies, are conferred upon the successful completion of studies in any of the dental colleges of France."

8. PARTIAL RELEASES:

"While a graduate of a foreign dental college of the required standard, upon the presentation of his diploma before the proper authorities, is not prohibited from practicing as an assistant on commission in the office of a fully authorized dentist, yet he cannot practice under his own name until he shall have procured a State diploma. The new law permits of the total release from the 'stage,' the two-year period of probationary work, as well as partial release from the 'scolarité' or three-year-course in a dental college, upon presentation to the Superior Board of Public Instruction of excellent credentials in the way of college degrees, doctor's diplomas, or a dental diploma, but the securing of a dispensation is a slow, tedious process and requires the payment of numerous large fees. American dentists contemplating coming to Paris to practice should not fail to have their dental diploma viséed by the nearest French consul, and provide themselves with all credentials possible. It will aid them."

RELEASES:

In securing releases, the applicant for a partial release must produce evidence of having completed three years' work in a dental college. In no case will a diploma be granted unless the last year's work has been done in the school issuing a diploma.

Addenda.

"There are at present in Paris a number of graduates of American dental colleges employed in dental offices on a commission or salary and at the same time pursuing courses in local schools, thus preparing themselves for the examinations and for ultimate admission to practice under their own names."

Dental License Under Medical Laws.

The dentists of the United States, and particularly those of the States of Virginia and New Jersey, can obtain a fair idea of the character of continental dental license under medical laws from the Balkan States. Roumania and Servia require the applicant to possess the title of M.D.

Bulgaria.

"The Bulgarian Government has stated in a communication that, according to Article 120 of the Laws on Public Health in Bulgaria, any person who has successfully completed the course of a dental school and who desires to acquire the right to practice the profession of dentistry in the kingdom must pass an examination, called the "Colloquium," and that only Bulgarian subjects are admitted to the said "Colloquium."

Roumania.

The dentist in Roumania applies for a license to practice dentistry under the Roumanian Sanitary Laws.

These laws attract particular attention because:

1. Physicians', dentists', veterinarians', pharmacists' and midwives' licenses are provided for together in one series of enactments.

Extracts from Article 82:

"The authority of the Minister of the Interior, published in the *Official Monitor,* is necessary.

3. "Right to practice the above professions is given to:

(*a*) "Possessors of academic degrees granted by schools in Roumania.

(*b*) "Degrees and diplomas bestowed by foreign faculties upon Roumanian citizens.

(*c*) "Similar rights are granted to persons born in the country (not citizens) who have received their secondary education in Roumania.

(*d*) Persons possessing foreign diplomas must, in order to obtain the right to practice, first pass an examination.

"Only those persons who hold diplomas deemed equivalent to those provided for according to the law on instruction are admitted to take the examination giving the right to practice.

4. "The examination for the right to practice is conducted by the general board of the sanitary service, under the supervision of a jury composed as follows:

(*d*) "For dentists, of two members being surgeons of the Superior Sanitary Council, and *one dentist* named by the Sanitary Board.

5. "Candidates for the examination must pay the taxes pertaining thereto.

(*g*) "Doctors of medicine, veterinary surgeons and pharmacists, 300 lei (francs; about 57 90-100 cents U. S. coin).

(*h*) "A special regulation will determine the matter of holding such examination and the distribution of taxes."

5. "Article 83. Dentistry, as is the case with any other specialty of medical practice, cannot be practiced by persons other than *Doctors of Medicine* having the right to practice, having obtained such right according to the terms of this law, and having a diploma or a certificate which confers the right to practice dentistry in this country.

"Dentists without the degree of Doctor of Medicine, but who have studied their specialty in a school of dentistry and who have been engaged in the practice of dentistry four years prior to the time of the promulgation of this law, shall continue to have such right to practice.

All those who have obtained the right to practice under previous legislation shall continue to enjoy the right to practice.

"Persons without academic degrees, and designated as 'dental mechanics,' will only be allowed to work in connection with doctors and dentists who practice according to the terms of this law."

SECRET PARTNERSHIPS (Art. 83, continued):

"The formation of a partnership by which such a person, 'dental mechanic,' places himself under the protection of a Doctor of Medicine who does not practice dentistry, for the purpose of thus practicing in an illegal manner this specialty of medicine, is considered as a violation of the law and the offender will be prosecuted.

"A doctor who is proven to have conveyed to another by such a secret understanding a right which according to the law is absolutely *personal* shall be subjected to a fine of from 200 to 2,000 lei (francs), and the person who has profited by such a right, which the law does not recognize as belonging to him, shall be considered as practicing medicine illicitly and shall be prosecuted according to the terms of Article 88."

Servia.

According to the terms of Article 9 of the law regarding the organization of the sanitary service and the maintenance of the public health, it is provided:

1. "All doctors, surgeons, etc., including doctors of dentistry, desiring to obtain the right to practice their profession in Servia, or to enter the service of the State or communes, are required to be Servian Nationals; to have a *diploma* as a *Doctor of Medicine,* or some other certificate of equal value; to submit to an *assistant physician* in a hospital of the State designated by the Ministry of the Interior. Those that pass the examination receive the right to practice in Servia, and to enter the service of the State in case of necessity.

2. "Those that serve their time in military hospitals are considered as having passed such time in the State hospitals. Those that prove that they have passed a year in a clinic after they have received their doctorate degree are in a like manner considered as having passed their time in a State hospital. Recognized specialists who may have been admitted to the service of the State upon the proposal of the Grand Council for (Public) Health are exempted from any examination.

3. "The regulations regarding the official examination determined by the Minister of the Interior, acting in accord with the Grand Council for (Public) Health. Dental surgeons are not recognized in Servia if they have not also become Doctors of Medicine."

SOCIETY ANNOUNCEMENTS

National Society Meetings.

NATIONAL DENTAL ASSOCIATION, Cleveland, Ohio, July 25th to 28th, 1911. Secretary, Dr. H. C. Brown, 185 E. State St., Columbus, O.

AMERICAN SOCIETY OF ORTHODONTISTS, September 20, 21, 22, 23, 1911, Boston, Mass. Secretary, Dr. F. C. Kemple, 576 Fifth Avenue, New York.

State Society Meetings.

ALABAMA DENTAL ASSOCIATION, Montgomery, Ala., June 6, 1911.
Secretary, Dr. E. W. Patten, Selma, Ala.

ARKANSAS STATE DENTAL ASSOCIATION, Pine Bluff, Ark., about June 1st.
Secretary, Dr. I. M. Sternberg, Fort Smith, Ark.

CALIFORNIA STATE DENTAL ASSOCIATION, San Francisco, Cal., June 14, 15, 16, 17, 1911.
Secretary, Dr. C. E. Post, 126 Stockton St., San Francisco, Cal.

COLORADO STATE DENTAL ASSOCIATION, Boulder, Colo., June 29, 30, July 1, 1911.
Secretary, Dr. Chas. A. Monroe, Willard Block, Boulder, Colo.

DELAWARE STATE DENTAL SOCIETY.
Secretary, Dr. Warren Combs, 410 Delaware Ave., Wilmington, Del.

FLORIDA STATE DENTAL SOCIETY, Pensacola, Fla., June 20, 21, 22.
Secretary, Dr. W. A. Dean, Tampa, Fla.

GEORGIA DENTAL SOCIETY, Macon, Ga., June 8, 1911.
Secretary, Dr. DeLos H. Hill, Grant Bldg., Atlanta, Ga.

MAINE DENTAL SOCIETY, Fabyan, N. H., June 27, 28, 29, 30, 1911.
Secretary, Dr. I. E. Pendleton, Lewiston, Me.

MARYLAND STATE DENTAL ASSOCIATION.
Secretary, Dr. F. F. Drew, 701 N. Howard St., Baltimore, Md.

MICHIGAN STATE DENTAL SOCIETY.
Secretary, Dr. Marcus L. Ward, Detroit, Mich.

MINNESOTA STATE DENTAL ASSOCIATION, Minneapolis, Minn., June 9, 10, 1911.
Secretary, Dr. B. A. Sandy, Andrus Bldg., Minneapolis, Minn.

MISSOURI STATE DENTAL ASSOCIATION, Joplin, Mo., June 13, 14, 15, 1911.
Secretary, Dr. S. C. A. Rubey, Clinton, Mo.

MONTANA STATE DENTAL SOCIETY, Helena, Mont., June 2, 3, 1911.
Secretary, Dr. R. H. Severance, Great Falls, Mont.

NEW MEXICO DENTAL SOCIETY.
Secretary, Dr. L. E. Erwin, Carlsbad, New Mexico.

NEW HAMPSHIRE STATE DENTAL SOCIETY, Fabyan, N. H., June 27, 28, 29, 30, 1911.
Secretary, Dr. F. F. Fisher, 913 Elm St., Manchester, N. H.

NEW JERSEY STATE DENTAL SOCIETY, Asbury Park, N. J., July 19, 20, 21, 1911.
Secretary, Dr. Chas. A. Meeker, 29 Fulton St., Newark, N. J.

NORTH CAROLINA DENTAL SOCIETY, Morehead City, N. C., June 28-July 1, 1911.
President, Dr. A. H. Fleming, Louisburg, N. C.

OHIO STATE DENTAL SOCIETY.
Secretary, Dr. F. R. Chapman, Schultz Bldg., Columbus, Ohio.

OREGON STATE DENTAL ASSOCIATION, Portland, Ore., June 6, 7, 8, 1911.
Secretary, Dr. F. H. Walgamitt, Medical Bldg., Portland, Ore.

PENNSYLVANIA STATE DENTAL SOCIETY, Scranton, Pa., June 27, 28, 29, 1911.
Secretary, Dr. Luther M. Weaver, 7103 Woodland Ave., Philadelphia, Pa.

RHODE ISLAND DENTAL SOCIETY.
Secretary, Dr. C. A. Carr, 209 Spring St., Newport, R. I.

SOUTH CAROLINA DENTAL ASSOCIATION, Columbia, S. C.
Secretary, Dr. W. B. Simmons, Piedmont, S. C.

UTAH STATE DENTAL SOCIETY, Salt Lake City, Utah, June 23, 24, 1911.
Sec'y, Dr. W. G. Dalrymple, 2421 Washington Ave., Ogden, Utah

VERMONT STATE DENTAL SOCIETY, Fabyan, N. H., June 27, 28, 29, 30, 1911.
Secretary, Dr. H. F. Hamilton, Newport, Vt.

VIRGINIA STATE DENTAL ASSOCIATION, Richmond, Va., June 14, 15, 16, 1911.
Secretary, Dr. W. H. Pearson, Hampton, Va.

WASHINGTON STATE DENTAL SOCIETY, Tacoma, Wash., June 1, 2, 3, 1911.
Secretary, Dr. Burton E. Lemley, 930 C St., Tacoma, Wash.

West Virginia State Dental Society.
Secretary, Dr. F. L. Wright, Wheeling, W. Va.
Wisconsin State Dental Society, Eau Claire, Wis., July 11, 12, 13, 1911.
Secretary, Dr. O. G. Krause, Wells Bldg., Milwaukee, Wis.

Call of Oral Hygiene Conference.

The Oral Hygiene Committee of the National Dental Association hereby issues a call for a conference on Oral Hygiene, to be held in the Engineers' Building, Cleveland, Ohio, Friday, July 28, 1911, at 8 P. M.

This conference is called for the purpose of bringing together the oral hygiene workers of the country, with the object of discussing suitable ways and means of handling the oral hygiene problem of this country in the most effective and economic manner.

The object of issuing a call for a meeting at this time and place is that the National Dental Association meets in Cleveland, Ohio, July 25th to 28th, and the conference will be held immediately following the National Dental Association meeting.

The committee earnestly desires that every member of the profession interested in the all-important question of oral hygiene make it a point to be present at this meeting.

The Oral Hygiene Committee of
The National Dental Association
W. G. Ebersole, Chairman.
E. P. Dameron,
Richard Grady,
J. P. Corley,
H. C. Thompson,
B. Holly Smith,
W. A. White.

National Association of Dental Examiners.

The Twenty-ninth Annual Session of the National Association of Dental Examiners will convene at the Colonial Hotel, Cleveland, Ohio, Monday and Tuesday, July 24 and 25. Beginning at 10 A. M. Monday, three sessions will be held daily until the business of the association is completed.

Members of all State Boards, whether members of this association or not, are invited to attend. T. A. BROADBENT, Secretary.

705 Venetian Building, Chicago, Ill.

National Association of Dental Faculties.

The next meeting of the National Association of Dental Faculties will take place at the Hollenden Hotel, Cleveland, Ohio, Saturday, July 22, at 10 A. M. The Executive Committee will meet at 9 A. M. on the same day. Anyone having business to transact with the committee will please be present at that time.

B. HOLLY SMITH,
Chairman Executive Committee.

American Dental Society of Europe.

The American Dental Society of Europe will hold its next annual meeting in Dresden, Germany, July 28, 29 and 31, 1911. A most cordial invitation is extended to members of the profession to be present.

T. G. PATTERSON, Hon. Secretary.

2 Quai des Eaux-Vives, Geneva, Switzerland.

Minnesota State Dental Association.

The Twenty-eighth Annual Meeting of the Minnesota State Dental Association will convene in Masonic Temple, Minneapolis, June 9-10, 1911. Neither pains nor expense have been spared to make this the largest session in the history of our association.

Dr. C. N. Johnson, of Chicago, will present a paper on "Care of Children's Teeth," and Dr. W. H. G. Logan, of Chicago, will give a stereopticon lecture entitled, "The Diagnosis, Treatment and Prognosis of Phagenedic Pericemental Alveolitis."

In addition there will be chair clinics to the number of thirty, supplemented by a large table clinic in which well-known members of our profession from Minnesota, Iowa, Wisconsin, North and South Dakota will participate.

An extensive manufacturers' exhibit will also be another feature. All ethical men are cordially invited to attend.

BENJAMIN SANDY, Secretary.

827 Andrus Building, Minneapolis, Minn.